# ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXIV. No. 3456. FEBRUARY 18, 1944 9d. WEEKLY


# Minute Perception

## *How Electron-Optics Has Enlarged Revealing Power*

THE rate of progress in any branch of science is never steady. It proceeds by a series of widely spaced leaps, followed by relatively long periods of much slower improvement during which the principle responsible for the "peak" advance is perfected and consolidated. Scientific workers can, therefore, look forward to the possibility of their patient investigations being occasionally rewarded by a discovery that so greatly extends the scope of their achievements as to mark a new epoch, in which the benefit of their services to mankind quickly expands on a much greater scale than before. These rare occasions of special development are exhilarating.

### Third Major Advance

Such an event has occurred in optical science, for the faculty of minute perception, or microscopy, has within the last year or two accomplished its third and most sensational advance. Before the invention of the "magnifying glass" man had to depend upon his "naked" eye. Simple lenses, evolved from bottles filled with water, were first used for magnifying purposes in the thirteenth century, and one may imagine the enthusiasm evoked by the combination of several glass lenses to form the "compound" microscope, by Leeuwenhoek and others 300 years ago.

The original enlargement of about 100 times had been increased sevenfold by successive improvements before the substitution of invisible radiation for visible illumination of the object under examination produced a magnification of 1,000 diameters, which was then thought to represent about the limit of ordinary microscopy. But that supposition has not lasted long, for somewhat similar though more drastic modification of the lens system has created an electronic instrument of remarkable resolving power.

On another page Dr. W. Wilson explains what manner of apparatus this is and in the second portion of this article, which is to follow, he will indicate some of the capabilities of the device which has made it possible when utilising peak magnification to identify particles composed of only fifty atoms (six ten-millionths of an inch apart) thus permitting, for example, heretofore impossible microscopic examination of the grain structure of metals.

### Intense Illumination

But resolving power would by itself not be of service, were it not for another fortunate factor. The intensity of illumination by the electron beam is immensely greater than that of the brightest possible light source, being estimated as millions of times greater than the intensity of the sun's image. Hence extremely small masses scatter sufficient energy to make an impression on a photographic plate, or fluorescent screen.

Thus the width of the gap is being reduced between examination by light and X-ray analysis. With the former, complexity of the "geography" of the specimen does not present any difficulty, but resolution is seriously limited by comparison

with X-rays, which are, however, difficult to apply except to structures that are regular repetitions of a simple unit. Even if some kind of reflecting lens could be made capable of focusing X-rays the amount of energy scattered would be inadequate and, moreover, the interpretation of diffraction patterns is somewhat like that of solving a crossword puzzle. One cannot proceed directly, but must first guess and then test whether possible configurations explain all that the X-ray picture shows.

The usefulness of these investigational aids has been still further extended by recently devised interchangeable adaptors which permit a conventional electron microscope to be alternatively employed as an electron-diffraction camera. Indeed, it is not possible to predict the extent to which the coming generation will benefit from the revelations of this new tool of so great a potentiality that has been given to research workers.

**Film Propaganda**

THERE is no doubt that the cinema represents one of the most potent means of conveying propaganda. Visual impressions remain when the memory of the spoken word has faded. For this reason we have always considered that the British Electrical Development Association could do much more with the film than it has done. It is, of course, largely a matter of expense, but it is an expense which the wise member will be willing, or even anxious, to meet. But such films have to be very carefully produced; there must not be too large a pill and the jam must be plentiful enough to disguise its taste. This is imperative if exhibitors are to be persuaded to show the films, but even where they are designed for picked (non-paying) audiences the principle holds good.

**Old and New**

EARLIER films produced for E.D.A. represented good approaches to the ideal but were obviously experiments in an untried medium. It was interesting to see again the other day two of these. "Wisdom of the Wild" is worth seeing for its remarkable "close-ups" of nature (animals and insects making the most of their food supplies), but it is a "war effort" contribution by E.D.A. having little electrical flavour. The other, "The Village that Found Itself," is specifically electrical and, as such, suitable only for special showing; the photography is good but the characters are a little overdrawn. Nevertheless, it does a difficult task very well. The latest E.D.A. production is meant for the public cinemas and will be seen pretty extensively very soon. It will succeed mainly because it depicts some of the antics of the fatuous Mrs. Feather (Jeanne de Casalis)—a public favourite. Although it is designed to encourage fuel economy and on this account is "anti-developmental," it is in fact a good *electrical* film. It shows how very easy electrical appliances are to operate—"Too Easy" for the present time—but suggests ideas for the future. Two new films are on the stocks dealing with large-scale cooking and post-war housing and a further "documentary" of the part which electricity has played in the war is contemplated.

**Australian Home Planning**

PREPARATIONS are being made by the Electrical & Radio Development Association of New South Wales for a campaign to secure adequate electrical installations and equipment in post-war homes. This will be managed by a committee whose members will be individually charged with responsibility for various aspects of the campaign—lighting, wires and cables, domestic appliances, etc., and sub-Committees will be formed to deal with particular branches. The assistance of six overseas organisations is being sought. Among these are the British Electrical Development Association, a Canadian and a South African association, but it is significant that the other three are American, including the Electrical Manufacturers' Association of New York and the Chicago Electrical Wholesalers' Association.

**Thermo-Plastic Insulation**

A LARGE attendance at the I.E.E. last week attested to the keen interest taken in thermo-plastic cable developments. The paper then presented was the result of technical co-operation among cable makers and sets out what is now known of the practical aspects of the subject. It is clear that a debt similar to that owed to physicists in high-voltage cable technique is due to the chemist in the present instance. The paper should be regarded in the light of a progress report, as the possibilities latent in the situation are immense, as

Mr. T. R. Scott, its co-author with Dr. H. Barron and Mr. J. N. Dean, showed in his chairman's address to the Transmission Section.

**P.V.C. Cables**

THERMO - PLASTIC insulants are restricted in their make-up by the ingredients available under war conditions and are best known in the guise of polyvinyl chloride. There are other forms, and p.v.c. itself may be improved when a freer choice of compounds is possible. Its leading characteristics, as affecting the I.E.E. Regulations, were commented on by us three weeks ago. Although p.v.c. meets most wiring needs, it should not be regarded merely as a rubber substitute, but rather as offering an extended range of insulating material. Its ultimate field will be decided after further research, extended experience of its utility and the future price of rubber, which has hitherto proved so satisfactory over the wide range that it has in common with the newcomer.

**Saving Coal in Mines**

ANY national assessment of possible fuel economies should pay early attention to the avoidance of waste at the source. Data on the lines presented by Mr. B. L. Metcalf for South Wales in his I.E.E. Transmission Section paper are needed for other coalfields, but meanwhile it may be deduced from his figures that the complete electrification of British collieries would reduce the amount of coal used in raising the total got by over three million tons per annum—enough to enable public electricity generating stations to increase their output by about 15 per cent. without the overall combustion of more fuel. From the economy aspect, the advisability of using a direct electric drive wherever permissible below ground is indicated by its lower power requirements, which are less than one-quarter those for compressed air.

**Colliery Generation**

IN suggesting that the public supply undertaking should carry the colliery morning peaks, Mr. Metcalf is on more debatable ground. This would generally entail saddling the cost of supply with the standing charges on transmission lines and on generating stations laid out to produce kWh at the lowest running cost, thus failing to take full advantage of high load factor of consumption. Reliability of supply is, as the author states, particularly important in mines, since it involves the safety of men below ground. Fairly efficient generating plant built for working with commercially non-transportable coal could be used for providing a skeleton safety service, supplemented, if necessary, by sets having quick-starting features. In any case the retention of obsolete steam engines seems unjustifiable in view of electrical alternatives which offer equal security.

**Not Proven**

IN commenting in the *Electrical Review* of January 21st, on the claim reported to have been made in New York by Prof. Felix Ehrenhaft regarding the discovery of " pure magnetic current," we suggested that the particulars published in the daily Press were insufficient to warrant any definite conclusion being drawn. Our caution is shown to have been justified by experiments carried out in Great Britain to which reference is made on another page. These appear to show that the phenomena said to form the basis of the claim can be ascribed to other and more generally accepted causes.

**Pub-station**

SUBSTATIONS of many designs have been built to conform with their surroundings, but the strangest combination we have met so far is reported in a South African contemporary. This states that the increasing demand for electricity around and beyond the Umgeni River, coupled with the policy of the Durban City Council to provide catering facilities for natives in the vicinity of their employment and residences, has led the Council to call for the erection of a combined native eating-house, beerhall and electric substation at a total cost of £12,350.

**Guidance for the Laity**

THE *World's Press News* mentions among strange statements which have lately appeared in daily papers the case of an evening journal which announced that bauxite is now being used as a substitute for aluminium in the building of aeroplanes. The same authority described cooling towers at a German power station bombed by Allied airmen as " blast furnaces." At least we suppose they were cooling towers—the *W.P.N.* uses the somewhat unusual term " condenser towers."

# Electron Microscope

## *Part I : The Instrument*

**By W. Wilson,**
D.Sc., B.Eng., M.I.E.E.

UNAIDED, the human eye, if exceptional eyesight is disregarded, can at most resolve (perceive as distinct entities) two points or lines 200 microns (0·02 cm.) apart. Lenses, in the form of single units, can only magnify about 5 or 6 diameters readily, the maximum possible gain being about 10 diameters.

The combination of two or more glass lenses to form the " compound " microscope permitted magnifications of about 100 times to be attained, which subsequent improvements have increased, successively to 200 and 400 times, and then by the use of an oil-immersed objective to 700 times. A final advance was secured by the substitution of invisible ultra-violet illumination for visible light, producing a magnification of 1,000 diameters, which represented about the furthest limit of microscopy.

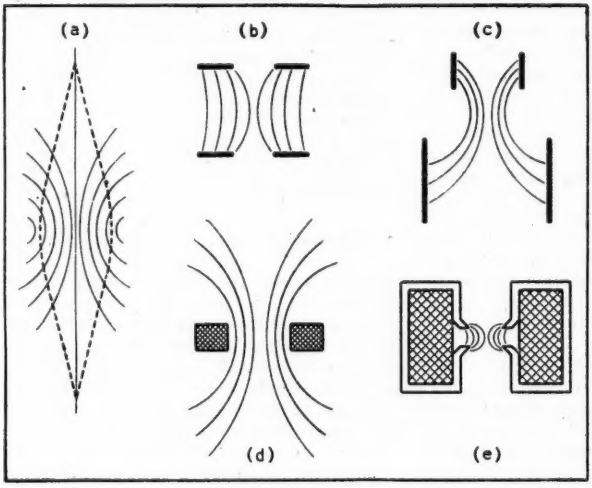



**Fig. 1.—Examples of axially symmetrical fields, electric or magnetic, acting as electron lenses**

The change-over, however, involved several marked disadvantages, for quartz lenses must be used instead of glass, which is opaque to u.v. light, and also the invisible image must be viewed by projection upon a fluorescent screen instead of being seen directly by the eye. At a magnification of 1,000 times the resolving limits of 200 $\mu$ (microns) for the naked eye and 20 $\mu$ for the best single lens had been reduced to 0·2 $\mu$. A value of 0·3 $\mu$ is the best possible with visible light; and when it is realised that the successive reductions have brought the image-size to less than the visible wavelength, which ranges from 0·7 $\mu$ (red) to 0·4 (blue), the reason for the limit will be understood. It can readily be proved mathematically that two particles separated by less than about half the wavelength of the illumination by which they are viewed cannot be perceived as two distinct entities, however much their image be magnified. This was first realised about 60 years ago, and some improvement was secured by the use of the lower wavelength " light."

It appeared likely, therefore, that particles smaller than 0·2 $\mu$ in width or diameter could never be distinguished, but another invisible radiation was to solve the problem. Already in 1897 Sir J. J. Thomson had employed a cathode-ray stream of electrons to furnish a visible indication and in 1924 de Broglie showed that they behaved as though they possessed a wavelength dependent on the anode-voltage of the tube producing them, the value for 60 kV being actually $10^{-5}$ that of visible light. There was hence a possibility of securing up to 100,000 times the magnification previously obtainable.

Most of the technique for producing a microscope actuated by cathode-rays or electrons was therefore in existence, and the further development into a practical instrument with a truly amazing magnifying power was so rapid that even scientific people were taken very much by surprise. Successful models were made (among others) by Knoll and Ruska on the Continent in 1932, by Martin, Whelpton and Parnum at the M.V. Co. in 1936, and by Prebus and Hillier at Toronto University in 1938; of which the last two attained a magnification of about

× 20,000, or 20 times that of the light microscope. In 1941 Hillier co-operated with Zworykin and Vance of the R.C.A. Manufacturing Co. to place on the market a highly finished and mass-produced microscope, suitable for general laboratory use, capable of magnification up to × 150,000, and a veritable flood of new discoveries has resulted.

### Electron Lenses

Whereas glass of usual thickness is opaque to u.v. light, any material much thicker than $10^{-6}$ cm. is opaque to an electron beam. This consists of a stream of negative charges of electricity moving with about one-tenth the velocity of light. It is therefore not only deflected by an electric field, but (functioning as a current) it is also refracted by a magnetic flux. Any axially symmetrical field, electric or magnetic, will therefore act as an electron lens.

In all of them the stream of electrons is passed through a flux that has its centre-line axial to the beam, but curves outwards at the ends. The principle is shown at (a) (Fig. 1) where two divergent beams are being bent back so as to meet at a desired point. At (b) an electrostatic flux of the desired form is produced by two parallel discs, pierced with holes at their centres, and maintained at different voltages, while the same is accomplished by means of tubes at (c). Magnetic flux is generated by the coil in (d), a development of which is shown at (e), where an iron core provides a low reluctance path for the flux over most of its length. The forms illustrated at (b) and (c) are much used for glass cathode-ray tubes, and that at (d) for the large metal cathode-ray oscillographs. For microscopes, the higher the magnification required, the shorter must be the focus, and, in the case of electron lenses, the shorter must be the radius of curvature of the flux. The advantage of the form (e) will therefore be evident, and it is consequently that used in the most powerful microscopes.

Useful magnification demands sharp focusing, which involves the solution of a number of problems, mathematical and otherwise, whatever kind of lens may be used. In order that all the rays emanating from one point may meet at a second point, the refracting surfaces of the glass, or the shape of the flux lines, must be exactly correct, and this can only be achieved if various " aberrations " can be successfully countered.

Chromatic aberration is the most obvious form, and is due to the radiation, whether visible or not, having mixed wavelengths, which normally come to a focus at different points. Visible light is inevitably a mixture of different colours, but the difficulty is overcome to a sufficient extent by employing two different kinds of glass each having complementary effects on the most important wavelengths. For electron streams, the wavelength is a function of the anode voltage, and can be kept constant by first generating the electrons at exactly the predetermined voltage and, secondly, maintaining a high degree of vacuum in the main tube and thus minimising collisions with molecules of air. Since an appreciable time is needed for producing a photographic record (one second to about five minutes) a constant image is essential, requiring an anode voltage of negligible variation with time. Means are employed in practice for limiting changes to within about ± 0·002 per cent. of the correct value.

### Voltage Effects

The focus of an electron lens is also a function of the voltage applied to the electrodes, or winding, and in practice the adjustment of the focus is carried out by rheostatic or other control of that voltage, instead of by moving the lenses bodily as with the light microscope. It further follows that the focusing voltage, or voltages, must be kept to within about the same order of constancy as for the anode voltage, in the usual case of the electromagnetic lens, where the effects of the two variations are cumulative. When electrostatic lenses are used the two variations oppose each other, and it is hence practicable to design the anode arrangement and the lens system so that voltage changes exactly cancel out. A great advantage of the electrostatic microscope is therefore that a " rough " voltage may be used, without elaborate smoothing.

Spherical aberration is the other important source of distortion. With glass lenses it is minimised either by the use of a small stop (or aperture), or by an intricate arrangement of elements in each lens, the former necessitating an exposure varying inversely with the square of the aperture. With electron lenses there is also a choice, between a small stop and a special design of the pole-pieces, or electrodes. Research is being energetically

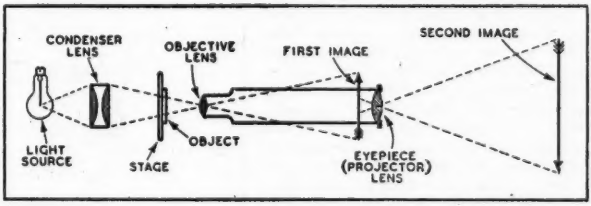



**Fig. 2.—Optical microscope assembly for photographic recording**

carried on at the present time upon the correction of spherical aberration, and is bringing about a gradual increase in the possible magnification.

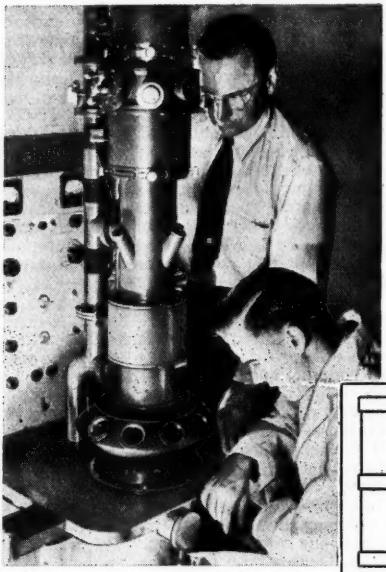


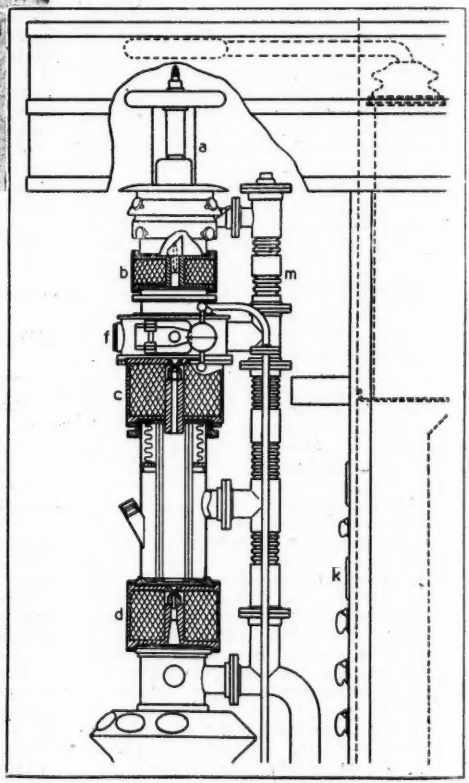
**Fig. 3.—Standard R.C.A. electron microscope under test by Drs. Zworykin and Hillier, and (Fig. 4) cross-section, showing lenses at b, c and d**

Since the electron microscope is the exact equivalent of the " optical " instrument, we will consider the latter first. On the extreme left of the diagram (Fig. 2) is the light source, which would comprise a " bunched " filament lamp for visible light, or a small tungsten arc followed by a prism for u.v. light. A condenser lens captures a cone of the light emitted and concentrates it upon the object, which is supported upon the stage. The objective lens forms a first image of a part of the object as shown, and the eyepiece or projecting lens then enlarges a small portion of the first image to form the second image, which is focused upon the screen or photographic film. This diagram illustrates the exact set-up for, say, metallography by ordinary artificial light; or high power magnification of bacteria by means of u.v. light if a fluorescent screen be substituted for the more usual ground glass.

The arrangement is the same for the usual electron microscope, except that a cathode-ray discharge tube is substituted for the lamp, and electromagnetic lenses (as indicated in Fig. 1(e)) replace the three glass lenses. All the components, including the fluorescent screen, must be enclosed in a tube equipped with a high-vacuum pumping plant. Owing to the considerable length of this tube it is usual to arrange it vertically with the high-voltage end at the top. Short low-magnification electromagnetic or electrostatic tubes are, however, generally placed horizontally (as in Fig. 2).

### Typical Examples

The microscope with electromagnetic lens (standard R.C.A. pattern) of which there are perhaps a dozen at work in this country, is about 6 ft. 6 in. high and its design has been so elaborated that, although it employs an anode voltage of 55 to 60 kV and possesses over 50 valves, it can be readily and safely operated by a microscopist knowing nothing of electronics or even electricity.



All high-voltage parts are either protected by the canopy or immersed in the oil-tank in the upper half of the cubicle (Fig. 3), while the other live parts are in the lower portion, their control being conveniently effected by knobs and instruments (k) just behind the main tube (Fig. 4) which consists of a number of sections making vacuum-tight joints with the ironclad electron lenses, and where necessary with one another, by means of broad flanges or metal bellows. At the upper end is the small discharge tube (a) containing the hot cathode at its apex, with the anode-block and aperture just below. Between the condenser lens (b) and the objective (c) is an airlock (f) by means of which the specimen is introduced without releasing the vacuum in more than a small portion of the tube, the time involved for re-pumping being only about two minutes. A second lock is provided at the base of the tube for the insertion and removal of the 10 in. by 2 in. photographic plate upon which a succession of six or more micrographs are taken.

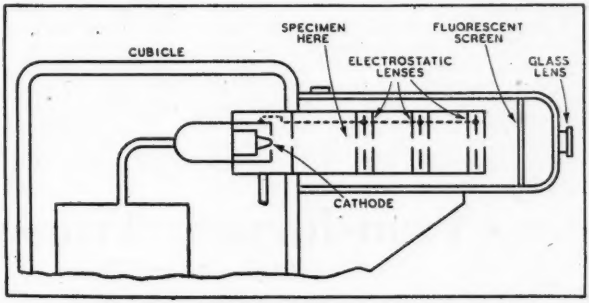



**Fig. 5.—Portable G.E. of America microscope with horizontal tube**

As the sections of tube are separated by the lenses, a flexible manifold tube (m) is fitted which connects them all to the evacuating gear in the enclosure below the tube. This consists of a rotary mechanical pump backing a three-stage oil-diffusion pump, by which a vacuum of about $10^{-5}$ mm. of mercury can be created in about 20 minutes.

The necessary degree of constancy has been secured for the voltage supplied to the anode and to each lens by deriving it from a 32 kc/s oscillator through rectifier-filter circuits with negative feed-back regulation, whereby very perfect smoothing is effected, thanks to the high frequency employed, while the screening problem is greatly simplified for the same reason.

The lens construction enables a very short focus to be obtained; as the object and the first image respectively must be as close as possible to the flux-field, the air-gaps are arranged close to the top of the core for the objective and projecting lenses. Even so, it is necessary for the object, after it has been inserted in the tube, to be lowered bodily by means of an external lever to bring it to the right position. In spite of the care taken to minimise spherical aberration by the design of the magnet system, a stop of only 0·02 mm. in diameter is employed, which can transmit less than 1 per cent. of the radiation falling on it. Notwithstanding this loss, a bright, easily visible image is furnished even at the highest magnifications, and photographic exposures are relatively brief.

To enable the wanted part of the object to be located, an upper fluorescent screen is provided upon which the first image is focused and viewed through one of the upper peep-holes. The main screen can be inspected with both eyes through the six ports at the base of the tubes. This screen can be rotated out of the way of the photographic plate when a micrograph is to be taken, and hence acts as a shutter for timing the exposure. Delicate adjustment of the object position can be effected from outside the tube.

Magnifications with a range from about × 2,000 to × 30,000 are obtained at will by manipulation of the electrical controls, but further enlargement of up to 6 or 7 times these values is obtained by photographic means without exhausting the detail in the micrograph negative. Thus a maximum of about × 200,000 can be secured by using the greatest precision throughout.

Recently the same makers have brought out a smaller model, with a nearly horizontal tube, at a cost of about half that of the original large pattern. It is mounted on a desk containing the high-voltage parts, control gear, and pumps, being intended to operate at an anode voltage of only 30 kV. The design is simplified by the omission of most of the adjustments: for example, the magnification on the photo-plate is fixed at × 5,000, but as further enlargement of as much as × 20 is possible, a total magnification of up to × 100,000 is obtainable.

The smaller model, which is not yet on the market, will be very suitable for many works laboratories where the very highest magnifications are not desired. The image is very easily scrutinised, as the fluorescent screen is at the end of the tube. Records are obtained by interposing a photographic plate before the inside face of the screen by means of an external turn-button.

Another recent example is that produced

by the G.E. of America (Fig. 5), with the tube horizontally projecting from the upper part of an enclosure containing the high-voltage supply (which is virtually unsmoothed) and the vacuum pumps. The length of the main tube is only 11 in. from the hairpin-shaped hot cathode on the left to the fluorescent screen, which is viewed and photographed through a glass lens, providing the last stage in the magnification.

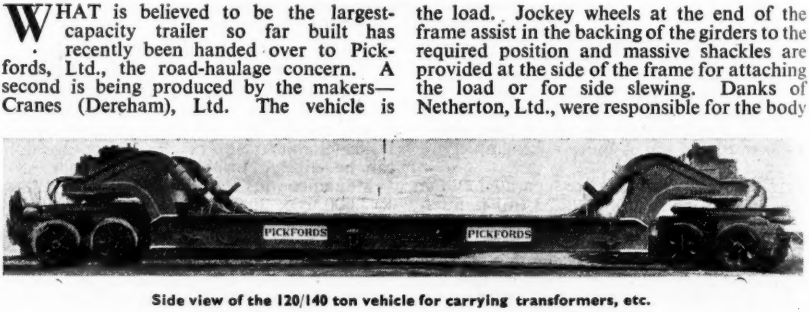
A magnification of only × 500 has been required from the electron lenses, which can, however, be increased to 7,000 or 8,000 by optical or photographic enlargement before blurring occurs. Voltages up to 35 kV are provided by the power unit, which can be smoothly regulated by a "Variac" device from a very low minimum value up to the maximum. This single high voltage feeds not only the anode, but also the inner diaphragms of three successive lenses of the type shown in Fig. 1(b), but each with three pierced discs instead of two. As the outer diaphragms are all at earth potential, a very simple arrangement (shown diagrammatically) is the result. A single-stage oil-diffusion pump and a small rotary mechanical pump have been found sufficient for convenient evacuation. The aim of the designers has been to provide a light, portable and comparatively inexpensive instrument, giving moderate magnifications which are still much greater than those obtainable from the light microscope.

Part 2, which it is hoped to publish next week, deals with specimen mounting and some typical results.

# Transformer Transport

## *A 61-ft. 140-ton Trailer*

WHAT is believed to be the largest-capacity trailer so far built has recently been handed over to Pickfords, Ltd., the road-haulage concern. A second is being produced by the makers—Cranes (Dereham), Ltd. The vehicle is intended for indivisible loads up to as much as 140 tons, such as large electric transformers.




**Side view of the 120/140 ton vehicle for carrying transformers, etc.**

It will be seen from the illustration that the trailer has two identical ends. The overall length is 61 ft. and the overall height 8 ft. 3 in. The travelling height of the platform is 3 ft. and it is adjustable between 2 ft. 3 in. and 5 ft. 1 in. This enables the load to be lowered under low arches and raised over hump bridges and the frame can also be adjusted to the height of stagings when being loaded or unloaded.

The lower ends of the swan necks are hinged to the ends of the main girders, their upper ends being attached to the top of the latter by two hydraulic jacks or struts. Petrol-engine driven pumps at each end deliver oil to the jacks which can be operated together to raise the frame to give a total clearance of 2 ft. 10 in. or to lower it to the ground. Emergency hand pumps are also provided.

The swan necks can easily be detached, leaving just the main girders for passing under the load. Jockey wheels at the end of the frame assist in the backing of the girders to the required position and massive shackles are provided at the side of the frame for attaching the load or for side slewing. Danks of Netherton, Ltd., were responsible for the body of the vehicle, which is a very fine example of fabrication by welding.

Special attention has been given to the connections between the swan necks and the bogies and adjustable three-point suspension is achieved. To obtain easy steering and to avoid a long overhang of the swan neck the bogies have been constructed as compactly as possible. Each has eight wheels fitted with 771 mm. by 15 in. solid rubber tyres and taper roller bearings, the axles being specially sprung.

Three steering methods are available. In the first the rear bogie can be locked in line with the main frame, enabling the vehicle to be trailed along wide roads and around fairly large curves. The second method entails having a tractor at the rear, while the third requires a steersman on the rear bogie who is in microphone and amplifier communication with the driver of the tractor.

All the wheels are equipped with special hydraulic brakes. Simultaneous action on both bogies is secured by a Bendix-Westinghouse relay system.

# Electricity in Ships

## *Some Disadvantages of AC*

THE electrical equipment of ships is dealt with in a paper, which is mainly descriptive, submitted by Mr. S. Booth (electrical superintendent, Blue Star Line, Ltd.) to the North-East Coast Institution of Engineers and Shipbuilders.

Generally DC is distributed on the two-wire system at 100/110/220V with both poles insulated. The single-wire DC system at 100/110 V with hull return is limited to vessels employing electricity mainly for lighting, as it is undesirable to allow the hull to conduct large currents and, moreover, the small advantage gained in saving cable is liable to be off-set by more frequent breakdown. Most recently built ships of medium tonnage, even those with dynamo capacities of less than 15 kW, employ the two-wire system.

The "tree" system of distribution is usual, sometimes modified to form ring mains; the advantages of the latter in a warship are evident, but the installation cost is greater on account of the greater number of fuses and circuit-breakers.

### Earthed Lead-covered Cables

The author strongly recommends that braided lead-covered cables should have their sheaths earthed at both ends of every continuous length in all circuits. If earthed only at the supply end, a breakdown of the insulation may cause the lead sheath beyond the fault to become "live," since the braiding will act as a partial insulator between the lead and earth. This may result in more faults further along the same length of cable due to leakage through the braid, possibly damaging adjacent cables.

After briefly referring to some cost considerations of other infrequently employed DC and AC systems of distribution the author explains why British consultants and designers favour DC whereas there appears to be a preference for AC for certain vessels built in America. This subject involves a study of the varied duties of different kinds of motor-driven auxiliary machinery, particularly deck equipment.

It is generally agreed that electrical advantages are to be gained by using AC motors, but when it comes to choosing the appropriate type for a particular duty it may be found that in certain vessels the advantages become less evident. Various auxiliary duties are tabulated in an appendix as an index of the starting torques needed, degrees of speed control required, and load conditions imposed on the DC driving motor usually associated with each case. Of the twenty-five instances mentioned, only five could be driven by an AC motor in its simplest form, meaning normal squirrel cage with direct-on-starting, and this only if 5 BHP is not exceeded, as demanded by the classification societies; otherwise some means of limiting the starting current must be provided. Another six duties may have s.c. motors, but must have starters. Three further duties would require high-torque s.c. motors, but for the remaining eleven duties s.c. motors would be unsuitable.

The author shows how in some instances the driven plant might be so modified as to avoid the necessity for motors of high starting torque and/or variable speed but admits that the methods are clumsy and less efficient than DC driving. Deck machinery is perhaps the most difficult for AC motors, unless a single-phase system with commutator motors be used, which would defeat the whole object.

Last the parallel running of generators is considered. The prime movers of DC generators can, and Diesel sets in particular often do, vary their speeds slightly with changing load without materially affecting their ability equally to share the load; if necessary it can be compensated for by adjusting the compounding of the dynamos. In contrast, unless the engines driving alternators maintain exactly similar governing characteristics they will not (automatically) take up an equal share of a continually varying load.

Incidentally individual alternator loads cannot be adjusted simply by shunt-field regulation at the switchboard (as with DC); the fuel oil or steam supplied to the engines has to be varied, which may call for remote control mechanism between the switchboard and engines. Also compound-wound dynamos are practically instantaneously self-regulating in adjustment of voltage with changes of load, whereas most AC voltage regulators depend upon gravity action and are unreliable when subjected to motion in a heavy seaway, while the paralleling of alternators demands more exactness and greater presence of mind on the part of operators than DC generators do.

Therefore, in many cases, normal practice will have to be departed from in some degree before it becomes economical to employ AC motors for all marine auxiliaries.

---

## Society of Engineers

**Mr. Frank Parfett delivered his presidential address to the Society of Engineers at Burlington House, W.1, on Monday last. He dealt principally with the education of young engineers and the need for co-ordination between engineering institutions.**

# "Magnetic Current"

## *Tests of Prof. Ehrenhaft's Claim*

EXPERIMENTS carried out by Mr. J. T. Kendall of the research department of Metropolitan-Vickers Electrical Co., and described in *Nature*, do not support the claim recently attributed to Prof. Felix Ehrenhaft that he had discovered the existence of "magnetic current." The electro-magnet used by Mr. Kendall produced an average magnetic field between the pole pieces of 11,000 gauss. In order to ensure the absence of leakage currents through the liquid, the soft-iron pole pieces were soldered to a brass block placed between the ends of the horizontal electro-magnets. The extended pole pieces dipped into dilute hydrochloric acid.

On switching on the current the stream of bubbles tended to be deflected into the 1·5-mm space between the soft-iron pole pieces, some of them downwards against their buoyancy. This was found to be due, however, to rotary currents in the liquid. The pole pieces were then covered with a film of paraffin wax and immersed in a solution of ferrous chloride. No bubbles were then formed and the liquid was immobile, until water was slowly poured into it to provide a non-uniform concentration of ferrous-chloride, but the consequent motion of the liquid died away when the pouring ceased and the concentration became uniform once more.

The movement of the liquid is explained as due to the tendency of those parts that contain the highest concentration of paramagnetic ferrous ions to move into the strongest field. Other electrolytes, used with both waxed and unwaxed pole pieces, showed that the general movement of the liquid depended upon the presence of ferrous or other ions of high magnetic susceptibility. The pole pieces were next heavily plated with cadmium, when the motion of the gas bubbles was unaffected by the magnetic field, indicating their movement to be due to that of the liquid.

In order to test the claim that oxygen is evolved at the north pole and hydrogen at the south pole, a thin strip of mica was placed between the poles and the gas collected from each separately. The volume of oxygen, ascertained by heating a platinum filament to redness, contracted to the extent 0·54 and 0·49 per cent. from the north and south poles respectively. This small percentage of oxygen was to be expected since the pole pieces were warmed by the current in the magnetising coils, thus releasing the air dissolved in the acid.

No attempt was made to confirm the statement regarding the decrease in pole strength; this would follow from any dissolving of the permanent magnet. The view is expressed that the effects attributed in the daily Press to Ehrenhaft may turn out to be no more valid than those relating to the existence of charges smaller than the electron. It is suggested that the observation of movement of the liquid caused by paramagnetic ions in the magnetic field may have value in forming a basis of a method for separating the rare earth elements, aqueous solutions of which differ markedly in magnetic susceptibility.

# E.R.A. Annual Meeting

## *Capt. Donaldson Elected Chairman*

THERE was a very small attendance at the annual general meeting last week of the British Electrical and Allied Industries Research Association. Mr. C. Rodgers, chairman, who presided, moved the adoption of the report and accounts with an expression of pleasure at Lord Falmouth's consent to serve as president for another year. He pointed out that the wide scope of the E.R.A. work of the "common denomination" kind was evident from the annual report (to which reference was made in our issue of February 4th, 1944, p. 161), but much additional work of the highest priority was being done directly for the services. Some of this would have a post-war value to the Association and that work was being paid for by the Government apart from the normal grant made through the Department of Scientific and Industrial Research.

Apart from member firms' own laboratories, "outside" bodies carrying out investigations for the E.R.A. included sixteen universities and university colleges, while about a dozen agricultural colleges were collaborating. The acquisition of a new site for extended laboratory facilities at Leatherhead might be regarded as the opening of a fresh chapter and would better fit the E.R.A. to undertake what was asked of it.

The chairman remarked that the financial statement did not need commenting upon; both the report and accounts were adopted without question. Among members of Council due to retire by rotation was Capt. J. M. Donaldson (representing the I.E.E. and I.A.E.P.C.) but the E.R.A. is not to lose his services for he was elected chairman of the Association at a subsequent afternoon meeting.

# Thermoplastic Cables

## *Scope and Methods of Handling*

CIRCUMSTANCES which have led to a considerably increased use of cables covered with thermoplastic substances are reviewed in a paper, written on behalf of the Cablemakers' (War Emergency) Technical Committee by Messrs. H. Barron (Pirelli-General), J. N. Dean (Telegraph Construction & Maintenance Co.) and T. R. Scott (Standard Telephones & Cables), submitted to the Installations Section of the Institution of Electrical Engineers.

Probably 25 per cent. of the output of rubber cables has now been changed over to the thermoplastic type, although the consumption of synthetic thermoplastics by the cable industry was probably less than 5 per cent. of the rubber consumption in 1941. The authors point out that the relative importance of the new kinds of cable cannot yet be evaluated on a peacetime basis, since an economic level cannot be established and because another competitor (synthetic rubber) is now making its appearance.

### Building-up of P.V.C. Compounds

But in order to establish such a basis it is desirable thoroughly to understand the general characteristics of thermoplastic cables; the authors therefore set them out, explaining the polymer situation, defining a thermoplastic material and indicating the resulting implications. The building-up and testing of p.v.c. (polyvinyl chloride) compounds are discussed, the manufacture, uses and installation of cables insulated with this substance being considered in detail.

The authors conclude that these substances when suitably selected, form satisfactory insulating and sheathing compounds for wires and cables capable of replacing corresponding rubber-covered types. Oxidation need no longer be considered as the predominant factor in determining life; there are still factors which prevent thermoplastic cables from being worked at temperatures appreciably in excess of those appropriate to rubber cables, but this may be countered by development and design along lines that would be impracticable for rubber.

Cable engineers have acquired a range of alternative materials and the probability is that both natural and artificial rubbers as well as thermoplastic materials will all play their parts in future cable development. On the one hand the chemical inertness of thermoplastics is evident; on the other, rubber possesses excellent electrical characteristics and great mechanical strength, its weaknesses having been masked to a great extent by the ingenuity of the cable engineer. No one thermoplastic can cover the range of applications to which rubber has been adapted. For each specific application, however, it is probable that a thermoplastic, or compound, can be devised which will compare favourably with rubber. It has undoubtedly been proved that p.v.c. is an adequate substitute in many cases and polythene, if supplies had been available, would have proved similarly valuable. Both have made it possible to manufacture cables and wires with important characteristics which cannot be equalled by rubber, but it is not reasonable to assume that rubber will be largely eliminated.

Users must be prepared to revise many traditional installation methods. Repairs and jointing are a somewhat different problem. Heat alone will not "weld" thermoplastic joints, simultaneous pressure is also required. One method of achieving this may be by the employment of high-frequency heating. The authors describe two alternative methods of jointing in which proofed tape is utilised to control the p.v.c. during the heating process.

In addition the soldering of thermoplastic wires needs to be studied, for this operation is undoubtedly troublesome at present. The application of pressure at cleats, clips and water-tight glands also requires further study, particularly when in combination with heat. The design of a gland for the newer kinds of cable differs considerably from that suitable for vulcanised rubber cable and users would be well advised to seek expert advice on this subject.

### Discussion

The first speaker in the discussion was Mr. G. O. Watson (vice-chairman, Installations Section) who said that in many respects p.v.c. cables might be considered superior to rubber, but it remained to be seen whether their thermo-plastic properties would be the determining factor in their continued employment. Little had been said in the paper with regard to installation and although it was suggested that expert advice should be obtained, where was this advice to be found? Government Department Electrical Specification 18, containing details of tests of the material was under revision at the moment. If p.v.c. cables were subjected to 120 or 130 deg. for a short time there was a chance that the conductor would sink through the insulation, due to its own weight. As to current-carrying capacity, he did not think it was safe to assume that the same ratings could be adopted as for rubber. Tests under ship

conditions had been carried out by E.R.A. ; these might be published in connection with the discussion. The application of pressure to these cables in hot situations should be avoided as otherwise the p.v.c. might be squeezed out. Further information about water absorption would be useful. Hydrochloric acid and chlorine could be given off by these cables ; what effect would follow from the emission of chlorine in case of fire ? After putting a number of other questions regarding the weaknesses of p.v.c. and suggesting precautions, Mr. Watson said that for 99 per cent. of building requirements, p.v.c. cables would be found to be admirable and, in many respects, as good as if not superior to rubber. Nevertheless, their shortcomings must be recognised.

Dr. P. Dunsheath said that readers of the paper must not imagine that they could make a p.v.c. cable which could be given a guaranteed life. There must be close co-operation between user and maker in drafting specifications, which should deal with performance and not manufacturing instructions, for what was done to-day might be very much out of date in ten years' time because of developments on the chemical side.

Dr. G. E. Haefeley emphasised the value of the paper in showing the importance of developing our own resources and avoiding dependence on other countries. He did not think it was sufficiently realised in this country that to ensure a safe future we must make better use of our own natural resources.

### Surface Installation Tests

Mr. G. Smith gave results of tests carried out with p.v.c. cable of the 1002 type. In the case of a building wired ten months ago, with surface wiring using turnbuckle clips, there had been no trouble. Another building, also wired on the surface and using insulated saddles gave satisfactory results after a difficulty through the pinching of the cables by the saddles had been removed. The results of tests of p.v.c. cable embedded in a slab of concrete and covered with five different kinds of plaster were also given. An initial "Megger" test was made in August last, subsequent tests being made in November and also a few days ago. The readings, all between poles, had been infinity on each occasion. The test slab was inside a building and the cables were maintained at 230 V to earth. The views of the authors and users about a suitable temperature range for general installation work would be welcomed.

Mr. S. W. Melsom (a member of the Cable Makers (War Emergency) Technical Committee) regretted that the authors had only devoted one or two paragraphs, mostly of a negative character, to installation. A great deal more would have to be known about temperature rise, although he was inclined to think the difficulties had been over-rated. Jointing need not be a worry in ordinary installation work, for it was rare to find a soldered joint, although it might be more important in certain work for the Services. People in the industry knew how to suit material to conditions and they would look on p.v.c. from the insulation worthiness point of view. After the war the whole question of the use of p.v.c. as against rubber would be one of economics.

### Better than Rubber ?

Mr. P. S. Cattle said that rubber had always given good service and it was too early yet to say that p.v.c. would be the better material. Rubber had stood up to hydrochloric acid for as long as ten years, but he believed there would be trouble with p.v.c. There was also the effect of light radiation and variations of temperature would make a considerable difference to the cost of erecting p.v.c. cables. Another point was the risk of damaging the cable when stripping p.v.c. insulation owing to the difficulty of controlling the depth of the cut, while the present finish of p.v.c. cables did permit of their being drawn into and out of conduit without risk of damage, although the use of braid assisted.

Mr. J. Veit referred to polyisobutylene as one of the few materials which would withstand both very high and very low temperatures. He foresaw a revolution in the manufacture of high-voltage cables owing to the use of polystyrene. Improvements were necessary to make p.v.c. withstand higher temperatures ; they related to the inner and outer reinforcement and the use of a second cotton lapping might assist in this connection.

Mr. H. J. Horn discussed p.v.c. cables in relation to their use in aircraft and spoke of their mechanical advantages for this purpose in comparison with the cellulose lacquered braided cotton covering now in use. There were four miles of cable in a modern bomber and the mechanical stability of the external covering was most important in view of vibration and the many awkward turns which had to be given to the cable. Temperature variations were also considerable in aircraft and if a p.v.c. cable could be obtained with a dielectric resistance of not less than 250 megohms per 1,000 yd. the aircraft industry would welcome it.

Mr. C. King (G. N. Haden & Sons, Ltd., and E.C.A.) said that as the contractor would not generally find it practicable to use more than one grade of cable for any particular building installation, and as the temperature range of the present C.M.A. standardised product was only 0 to 135 deg. F., the use of p.v.c. for most standard appliances appeared questionable. At one end of the scale was the working temperature of the terminals of deep-freeze refrigerators and at the other end those of lampholders, irons, kettles, toasters, water heaters, cookers, air heaters, etc.,

most of which were outside the permissible temperature range. Since the deformation of p.v.c. under pressure proceeded slowly with time it would become necessary to be constantly going round tightening cord grips, if fittings were to be prevented from falling, and this attention might lead in time to short circuits. As to cleat wiring, clip and such-like fixing methods, would not the good craftsman who prided himself on his ability to run a single cable or a bunch of them nice and taut, be driven to despair by the cold flow disability of p.v.c.? Its dielectric resistance was not a strong point, and the idea of jointing p.v.c. for building installations did not appeal to him. How did the colours react to heat; did they fade under light and was bleeding possible, with consequent staining of adjacent surfaces?

There were some corrosives which v.i.r. stood up to better than some synthetics. This question was one of economics and v.i.r. might continue to score in most cases because of its cheapness. At the present moment p.v.c. cost from 19 to 45 per cent. more than v.i.r. Because of the cold-flow disability of p.v.c., he believed that the more rubber-like materials, such as neoprene, had a more promising future.

### Installation Engineer's Acceptance

Mr. F. C. Raphael said that he was perfectly ready as an installation engineer to accept thermoplastic cables. A great deal had been said about the cold flow of thermoplastic cables, but there had always been cold flow with rubber cables. There were fewer troubles to face with thermoplastic cables than there were in the early days of rubber cables. For building work, very low temperature flexibility was not necessary. Obviously for normal work they should not be satisfied to make all cables to the Government Specification 18; there would have to be another providing for better qualities generally while conforming to low-temperature requirements.

Mr. D. B. McKenzie asked why the authors had not considered synthetic materials only as substitutes by virtue of special properties of their own not possessed by natural rubber. Any specification should include a performance test on the finished cable.

Mr. W. A. McNeill, speaking as a representative of a switchgear firm which had been using p.v.c. cable for small wiring for nearly two years, said that his experience had been mainly with Specification 1002 and the cables had been used in temperate climates, but he did not think there should be any difficulties in tropical climates. How would p.v.c. behave when subjected to rapid alternations of tropical and arctic temperatures, which would probably be encountered in aircraft?

Mr. E. E. Hutchings suggested that braiding would be a very desirable precaution in ships' cables in view of the considerable movement to which they were subject on account of the working of the vessel. As the thermal resistivity was high, it followed that the current-carrying capacity was lower than with the corresponding rubber cable. Was there any effect of the pigment in p.v.c. on their electrical properties and was painting of the cables, which was the common practice on ships, likely to affect them seriously? Abrasion tests had been carried out by the E.R.A. with satisfactory results.

### Saving in Space

Mr. S. F. Follett spoke of the advantages of the simplicity in construction of p.v.c. cable and said that the saving in space, owing to smaller size for a given capacity and labour in installation, would offset the higher cost of the basic material. The normal method of application of this material to cables was by extrusion and longitudinal application should be considered only as an emergency method. He urged the application of performance tests to the finished cable as well as to the material.

Mr. T. R. Scott, in some brief comments on behalf of the authors, said they had attempted to give a balanced survey of the subject in a frank manner, to admit the difficulties and point out the merits and try to make the user a little "plastic minded." They had simply put the case and tried to "draw fire" on what were the real installation problems. On the Cable Makers' (War Emergency) Technical Committee were a number of people who had used these cables and there had been a considerable amount of correspondence with users generally. There was a feeling that G.D.E.S. 18 did not go far enough in controlling materials and that the chemist was given too much scope, but that specification was being continually revised in such a manner that it was, if anything, controlling material perhaps too tightly.

## Telecommunication Terms

THE revised and enlarged edition of BS.204 (1943), which has been prepared in collaboration with the Post Office and other organisations, takes the place of what used to be the ninth and tenth sections of the old general electrical glossary. A short section has been added on fire alarms and a considerable number of new definitions have been introduced, the older ones having also been extensively revised. Some regrouping of the subjects has been carried out, largely with the object of bringing together general terms in common use by all branches of telecommunications into an introductory section, which is followed by more specialised portions respectively appropriate to telegraphy, telephony, radio-communication, television, radio direction-finding and the new fire alarms section, all in one volume with a complete alphabetical index. Copies of the new glossary are obtainable for 3s. 6d. from the British Standards Institution, 28, Victoria Street, London, S.W.1.

# CORRESPONDENCE

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.*

## "Only Lighting?"

THE criticism of Lord Woolton's observations in regard to the above in your editorial columns last week is most timely, but does not go far enough. What about the parrot cry of "Freedom of choice" started by the Minister of Fuel and Power last year, since repeated with emphasis by the gas industry in their post-war planning report, and now meekly echoed in the recent report of the *ad hoc* Committee of the Electricity Supply Industry?

It cannot be denied that electricity will be demanded in all new houses (and just as essential as water) for lighting and radio sets, not to forget television; vacuum cleaners and clocks might equally be included as electrical essentials. Therefore, the capital outlay must be incurred for *all* the paraphernalia of an electricity supply.

There is now ample evidence that all other domestic requirements of heating, cooking, etc., can be met as cheaply and efficiently by electricity as by any other means. It is freedom run riot to add to the heavy cost of providing new houses by installing duplicate or triplicate services.

A gas supply will need mains in roads, services to the houses, space for the meter, additional points in the rooms, additional service staff and additional accounts. A coal supply will need fireplaces, adding to the building cost and taking up valuable wall space, coal storage adding further to the cost, additional refuse to be collected and disposed of and additional coal transport, not overlooking the matches, firewood and additional labour involved.

Incidentally, the gas report, in a subtle endeavour to be impartial, pleads for the installation of fireplaces as well as gas piping, but studiously avoids electric wiring. Obviously they must plead for fireplaces (or flues) as the preliminary to gas fires, and the solicitude for fireplaces is, therefore, very apparent and necessary if there must be this "freedom of choice" (for gas).

What the report of the gas industry points out, that increase of consumption per consumer will result in a reduced average cost to the consumer, applies with equal force to electricity. It is due to having such heavy capital outlay, and being left with only the "pickings," so to speak, and a low consumption per consumer, that electricity supply undertakings have been unable to appreciably reduce the present moderate charges.

I repeat that it will be demanded on all sides that electricity must be available in every new house. Why not, therefore, restrict the cost by restricting the choice and plan boldly for the all-electric house?

*London, W.C.2.* F. W. PURSE.

## The Newport Appointment

IN the published recommendation of the Electricity and Transport Committee of Newport, my name appeared upon the "short list" for the appointment of electrical engineer and manager at a salary which is now stated to be £1,350 per annum. When applications were invited for this appointment candidates were requested to state the salary required. I, among other qualified applicants, stipulated the minimum of £1,650 per annum in accordance with Clause 10 of the Schedule to the Agreement of July 9th, 1941, of the Joint Committee of Local Authorities and Chief Engineers.

*Swansea.* A. C. THIRTLE, A.M.Inst.C.E., A.M.I.E.E.
*Deputy Engineer and Manager.*

I SHOULD like to associate myself with Mr. Thirtle's remarks to the effect that I also specified the minimum of £1,650 per annum for the Newport appointment. In reply to our inquiries it was stated that "no pronouncement could be made as to whether it was the intention of the Council to add annual increments to the salary offered to the newly appointed manager, in accordance with the Schedule."

I was asked by the appointing committee whether I would accept £1,650 as a permanent salary, which was refused. I believe it is a fact that various committees are adopting this procedure to evade the ban placed on certain appointments, and therefore the opprobrium attached to the applicants, by offering the minimum salary as a permanent one, or rising to something less than that specified in the Schedule. This is a matter which needs the attention of the A.M.E.E.

On the other hand, I understand that at one recent interview at least a question was put to the applicants, "Have you ever applied for a banned appointment?" This would appear to be a very desirable step in the right direction.

*Great Yarmouth.* R. C. GOLDING.

## Bathroom Deaths

MR. F. H. E. MYERS, in your issue of February 4th, has brought to notice something that to my mind should have been given very great attention years ago. I, and many others in the electrical

business, would, I am certain, welcome legislation. I have not, so far as my memory serves me, heard of anyone other than experienced engineers fitting extra gas or water points. Yet with electrical equipment every Tom, Dick and Harry seems to have a dabble, with the consequent result of accidents, such as have been brought to our notice recently in the *Electrical Review*.

Years ago I saw in a bathroom a 1-kW reflector fire let in flush with the ceiling, with the control switch on the landing. This was neat, safe, permanently fixed and right out of reach. The lighting was supplied from a 12-V transformer.

I should like to have your readers' views on 5- and 15-A multi-plug adaptors. These, to my way of thinking, are an easy way of supplying electricity to numerous appliances, but in the hands of the inexperienced may be dangerous.

*Rugby.* H. W. EDWARDS.

## Testing AC Motors

WITH reference to Mr. E. H. Werninck's alternative method of calculation in your issue of February 4th, while this is just as accurate, it does, in my opinion, involve a longer calculation. The whole object of the article was to give a simple and quick method of checking the load performance of an AC motor, and for this reason the use of the hot resistance was rejected, as this involves a provisional calculation to ensure that the motor is correctly loaded prior to its being put on heat run. Calculations using the hot resistance are, of course, more accurate, but the error involved by using the cold resistance is so slight that it can be ignored for the purpose of the test in question.

I am indebted to Mr. Werninck for drawing attention to two errors that escaped notice through a too hasty reading of the proof.

*Leicester.* K. BROOM.

I PREFER Mr. Werninck's method, particularly his use of hot resistance and his method of obtaining rotor losses, to Mr. Broom's. The following is an alternative method of taking the slip which dispenses with the need for taking r.p.m.

A millivoltmeter should be used, either connected across the ends of the shaft for a cage motor or actually on the rings or rotor leads for a slipring motor. If these methods are impracticable a compass needle on the yoke will show the same deflections. The deflections noted and taken over a period of time can be applied to the formulæ:—Percentage slip =

$$\frac{\text{number of deflections} \times 100}{\text{Time in sec.} \times \text{frequency of supply}}$$

From this it can be seen that if a time of 20 sec. is used with a normal frequency of 50 cycles, the percentage slip will be $\frac{1}{10}$ the number of deflections. This slip percentage is the equivalent of the $\frac{50}{1500}$ used by Mr. Werninck, and is used instead of it—it will be $3\frac{1}{3}$ per cent. in the case under review.

Incidentally, I would like to mention that B.S.S. 269/1927 and 168/1936 require all $I^2R$ losses to be calculated for a mean temperature of 75 deg. C. and stray-load losses to be taken into account. It adds that the use of other methods is misleading and not to be recognised, although I think this does not particularly apply to the case in point as it is testing after repair and is a relatively small machine.

*Stretford.* G. DAWSON.

## The Brighton Stoppage

IN your issue of February 11th you refer, under "Electricity Supply," to an "electricity breakdown at Brighton on the evening of February 1st." No mention is made of the cause, which was the development of a heavy fault on a C.E.B. substation which interrupted the C.E.B. supply to that station and also completely shut down the Southwick power station.

The text of your announcement implies a reflection upon the operation of the Brighton undertaking and I shall be obliged if you will correct this impression in your next issue.

*Brighton.* H. PRYCE-JONES,
*Engineer and Manager.*

## House Wiring Schemes

MR. A. J. HEELIS, in your issue of February 11th, inquires why socket outlets should be limited to 2 kW in view of the known fact that various domestic appliances in general use have a loading up to 3 kW. This is a very pertinent question and the answer to it is that some misguided people hold the view that labelling a 5-A plug point 10 A will make the world a better place to live in. They do not seem to appreciate that this would not only make it impossible for the largest class of domestic consumer to use any appliance above 2 kW, but that consumers', engineers' and maintenance men's lives would be made unbearable if millions of plug points were loaded up to their uttermost theoretical capacity, and the heat due to contact resistance added to by the heating of a fuse, also run at full load continuously.

It is true that the existing 15-A B.S. plug and socket is too large and costly for general domestic use, but this is not the only alternative. The obvious solution is the 3-kW domestic standard fused plug and socket which is not much larger than the present 2-A B.S.S. size and correspondingly economic in cost, whilst going comfortably into a standard cast-iron B.S. round conduit box. It is almost inconceivable that enlightened

engineers should contemplate with equanimity the prospect of consumers plugging 10-A appliances into 5-A sockets, some of which already overheat with a 5-A load.

*London, E.C.*4. R. AMBERTON.

CONSTRUCTIVE criticism is always valuable, but personally I cannot regard the remarks of Mr. D. P. Wilson as such. All the switch-sockets in my home are situated on the skirtings about four inches from the floor, but no one has to lie on his stomach to operate the switches or withdraw the plugs and there is no risk of anyone "braining" himself. If such outlets were arranged thirty inches from the floor, as suggested by Mr. Wilson, I have little doubt that that gentleman would be the first to complain about the flex being in the way and other obvious disadvantages.

*Glasgow.* ALEX. MILNE.

## Electricity Supply Reorganisation

WITH reference to "Safeguard's" letter in your issue of February 11th, I would suggest that before rushing into print he should have taken the trouble to read carefully the Memorandum in question. Dealing *seriatim* with one or two of the points referred to:—

1.—I do not understand his reference to "the promotion of tariffs" unless his intention was to advocate more uniform tariffs, with which I am in complete agreement.

2.—It is suggested that better load and diversity factors can only be obtained by constituting larger undertakings. I fail to see, however, how the size of an undertaking has any bearing on the matter in these days, when both large and small undertakings take their supply from the grid and not from individual stations.

3.—With reference to "Safeguard's" statement that 100 per cent. efficiency cannot be obtained from committees of, say, thirty councillors and one engineer representing a vast number of undertakings, may I suggest to him that he reads Clause 49 of the Memorandum. This states quite definitely that the Area Committees shall consist of not more than fourteen members of whom not less than half shall be engineers; of the remainder there is nothing in the Memorandum which suggests that they shall all be councillors, as company undertakings are also entitled to representation.

4.—It would appear from "Safeguard's" letter that he is of the opinion that the words "large," "efficient" and "more electrical brains"—whatever this last phrase may mean—are of necessity more or less synonymous terms, but, if this is so, I suggest that the views he expresses go to disprove this.

In conclusion, may I commend to "Safeguard," and any others who think as he does, the remark I heard made by a very well-known man a few years ago: "The greatest need of this country to-day is not so much men with brains as men with enough common sense and tact to know how to use their brains to the best advantage."

"COMMON SENSE."

# Alloy Steels

## *High-Temperature Tests*

TESTS carried out at Purdue University (Indiana) on the relative resistance to corrosion by steam of unstressed specimens of alloy steels at temperatures between 1,000 and 1,800 deg. F. show that rapid corrosion occurs beyond a limiting temperature which increases with chromium content.

Chemical analysis of the inner scale layer produced on chromium-molybdenum steels during 500-hour tests at temperatures of 1,500 and 1,730 deg. F. indicates a build-up in concentration of chromium, silicon and molybdenum. The diffusion of the alloying agents and the inward-diffusing oxygen combine to form the dense protective inner layer.

The rate of corrosion and the relative corrosion resistance of various unstressed materials that could be used in the construction of steam generators, piping and turbines have been investigated under operating conditions by the Detroit (Michigan) Edison Co. Specimens were exposed to steam at 380 lb. per sq. in. at 925 and 1,100 deg. F. for periods ranging from 4,000 to 16,000 hours. The investigation occupied five years, during which time forty-six materials were studied, including nickel, nickel-copper alloys, chromium and chromium-nickel stainless steels, medium- and low-alloy steels, carbon steels and alloy cast-iron.

Weight-loss, hardness and metallographic data were obtained for many of the samples. The weight loss for plain-carbon steel exposed to 1,100 deg. F. continued at a high rate, whereas for the alloyed materials it decreased with time. High chromium-nickel and the 12-chromium stainless steels were the most corrosion-resistant. The corrosion rate of 0·50 molybdenum and 1·0 chromium steels compared favourably with that of the 5-chromium steel. Non-ferrous materials were not as corrosion-resistant in high-temperature steam as the high-alloy ferrous materials. Materials which corroded rapidly at 1,100 deg. F. corroded only slightly at 925 deg. F., at which temperature there was little difference between the rate of corrosion of plain carbon and alloy steels.

## Purchase Tax Exemptions

CUSTOMS and Excise authorities have decided that printed books, leaflets and other letterpress matter are uot liable to Purchase Tax unless they are articles of stationery such as the examples of chargeable articles already given. Examples of non-chargeable articles are:—Advertising leaflets, catalogues and price lists, appeals on behalf of charities, etc., company reports and accounts, if fully-printed or containing merely incidental provision for insertion in manuscript or typewriting of, *e.g.*, the amount of a contribution to a charity, an application for membership, or an order.

# PERSONAL and SOCIAL

## *News of Men and Women of the Industry*

LAST week **Mr.** and **Mrs. Frank Forrest** were entertained to tea by the staff and employees of the Birmingham Electric Supply Department on the occasion of Mr. Forrest's retirement from the position of chief engineer and manager. Mr. F. W. Lawton, his successor, in presenting him with a sum for the purchase of a radio receiver, alluded to the remarkable progress of the undertaking and some of the outstanding features of Mr. Forrest's managership. Other testimony followed from representatives of the women and manual workers of the Department, to which Mr. Forrest responded in happy vein, and was followed by Mrs. Forrest in a delightfully humorous speech, indicating that Mr. Forrest's retirement was perhaps not going to be so idle as he fondly imagined.

**Mr. Stanley Gough,** who has been elected national president of the Electrical Power Engineers' Association, has been first assistant mains engineer to the Cardiff Corporation Electricity Department since 1937. Mr. Gough was born at Abersychan and received his secondary education at the West Monmouthshire School, Pontypool. His technical training was obtained under Mr. F. Rise, electrical engineer to the Pontypool Electric Light & Power Co., and Mr. W. Hampson, electrical consultant to colliery group electrification schemes in Aberdare. Before going to Cardiff as mains assistant in 1928 he served as assistant electrical engineer to the Bedwas Colliery Co. and as assistant on the e.h.v. distribution staff of the Ebbw Vale Steel, Iron & Coal Co., under Mr. H. Manley Roberts. Mr. Gough has been a member of the No. 4 Area D.J.B. for the Electricity Supply Industry since 1934, and a member of the National Joint Board since 1940. He has served as a member of the national executive committee of the E.P.E.A. since 1936. He is a vice-president of the Electricity Department Social Club and assistant general secretary of Cardiff Municipal Musical Society.

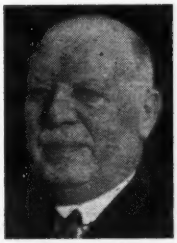
Mr. S. Gough

**Mr. G. E. Moore,** A.M.I.E.E., who becomes president-elect of the E.P.E.A., has been assistant engineer in the test and meter department of the Sunderland Corporation electricity undertaking since 1930. Mr. Moore was born at Hoylake, and received his early education at Liverpool Institute (High School for Boys) and his technical training at Liverpool Central Technical School. Upon leaving school he went to Liverpool Corporation Laboratory where he gained experience in instrument making and experimental work. From 1915 to 1919 he served in the Army and after being demobilised went into the test room of the Cambridge Instrument Co., leaving there in 1921 to work in the test department of the Newcastle-on-Tyne & Associated Companies (now the North Eastern Electric Supply Co., Ltd.), under Mr. E. Fawssett. With Mr. Fawssett he prepared a paper for the I.E.E. in 1931 entitled "Maintenance of Large AC Meters," and he has contributed several articles to the *Electrical Review*, mainly on meters and the advantages of all-insulated installations.

**Mr. T. H. Wood,** M.I.Mech.E., A.M.I.E.E., chief technical assistant in the Newport Corporation Electricity Department, has been promoted to the position of borough electrical engineer and manager, in succession to the late Mr. A. Nichols Moore, at a salary of £1,325 per annum. Mr. Wood, who is fifty-four, was educated at Nottingham University College and Sheffield University, College of Technology. He became an articled pupil with the Railway & General Engineering Co., Ltd., Nottingham, and in 1911 was appointed draughtsman in the Sheffield Corporation Electricity Department. From 1913 to 1915 he served as assistant engineer to the Doncaster Corporation Electricity Department and from 1915 until 1918, when he went to Newport as second technical assistant, he was construction engineer to the Battersea Corporation Electricity Department. While at Newport he has been responsible for supervising large extension schemes. He is chairman of the South Wales Branch of the Institution of Mechanical Engineers.

**Mr. W. J. Cusack** (Rugby) and **Mr. F. Hughes-Caley** (Birmingham) have retired after forty years' service with the British Thomson-Houston Co., Ltd. Mr. Cusack joined the staff in 1903, and after working in the commercial engineering departments for four years he was appointed manager of the Manchester office. In 1917 he returned to Rugby as manager of all district offices, and in 1932 he became assistant to Mr. Ramsden, director in charge of industrial sales, and Mr. Lingard, director in charge of lamp sales, on all matters relating to district offices.

Mr. Hughes-Caley also joined the company's staff in 1903, and after spending four years on traction work he was transferred to the supply department staff, and for the next ten years he was travelling representative for the southern half of England. He returned to Rugby in 1917 as chief assistant in the supply department and



Mr. W. J. Cusack

Mr. F. Hughes-Caley

in 1923 he was appointed manager of Birmingham office, having charge also of lamp depots at Leicester, Norwich, Cambridge, Northampton and Cheltenham. He has three sons, all of whom have received an engineering training at the B.T.H. works. The eldest is in the United States, the second in Canada, and the youngest is in the company's industrial sales department at Rugby.

The new manager of the Birmingham office is **Mr. S. Nichols,** who came from Brisbane and joined the B.T.H. test department in 1911. During the 1914-18 war he was an artillery officer in France and was awarded the M.C. In 1919 he re-joined the B.T.H. Co., and after two years in the supply department at Rugby he was transferred to the Birmingham office. In 1925 he was appointed manager of the Middlesbrough office, and in 1930 was transferred to the Liverpool office as manager. Three years later he became manager of the Sheffield office and has held that post for the past ten years.

**Mr. William A. Harriman,** director and works manager of A. Reyrolle & Co., Ltd., has resigned. Mr. Harriman has been associated with Reyrolles for many years. It is understood that **Mr. C. Stephens** has been appointed works manager. Reyrolle & Co. state that Mr. Harriman will continue as a director of the company and that his services will also be available in a consultative capacity.

At a luncheon held in the Midland Hotel, Manchester, on February 8th, the North West England and North Wales Consultative Technical Committee paid a tribute to **Mr. P. J. Robinson** on his retirement from the post of city electrical engineer of the Liverpool Electric Supply Department. Mr. Hartley Shawcross (Regional Commissioner), Mr. Gordon Macdonald (Regional Fuel Controller), members of the Electric Supply Committee and past members were present. In proposing the health of Mr. Robinson, Mr. Shawcross congratulated him on the efficiency of the Liverpool undertaking, and mentioned particularly the effective manner in which Mr. Robinson had organised supplies during the heavy German attacks upon the port. Mr. Lamb, who was in the chair, referred to Mr. Robinson's long and valuable services as a member of the Committee, and Mr. Robinson replied.

**Mr. Robert Stubbs,** who has been general manager and secretary of Lowmoor Best Yorkshire Iron, Ltd., for the last fourteen years, has been appointed a director of the company. The Lowmoor Ironworks are under the control of Thos. W. Ward, Ltd.

**Mr. H. J. Allcock,** production manager of Callender's Cable & Construction Co., Ltd., has been appointed works controller of the company's northern factories. **Mr. Eric Bowyer,** B.Sc., has been appointed production manager of the company's Anchor Works and associated factories.

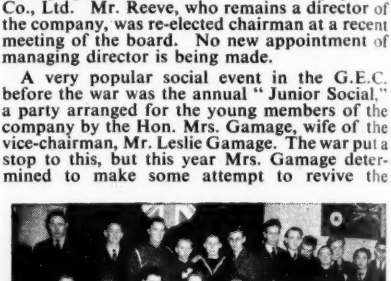
**Mr. R. C. Whitcroft** has been appointed a director of the River Plate Electricity and Other Securities Corporation, Ltd., in place of the late Mr. William Graham.

It was recently reported that the services of **Mr. H. A. Sharples,** public lighting superintendent at Blackpool, were to be retained for a further year from his retirement date last month. The Electricity Committee, however, reports that Mr. Sharples does not wish to continue, and the Committee has therefore appointed **Mr. L. Birtwistle,** assistant in the Department, as acting superintendent at a salary of £350 per annum.

**Mr. F. V. Pipe,** managing director of Newton Bros. (Derby), Ltd., was recently elected president of the Derby and District Association of the Engineering Employers' Federation.

**Mr. C. W. Reeve,** C.B.E., having reached pensionable age, has resigned from the position of managing director of the Associated Equipment Co., Ltd. Mr. Reeve, who remains a director of the company, was re-elected chairman at a recent meeting of the board. No new appointment of managing director is being made.

A very popular social event in the G.E.C. before the war was the annual "Junior Social," a party arranged for the young members of the company by the Hon. Mrs. Gamage, wife of the vice-chairman, Mr. Leslie Gamage. The war put a stop to this, but this year Mrs. Gamage determined to make some attempt to revive the



**Lord Margesson and Mr. and Mrs. Leslie Gamage at the G.E.C. "Junior Social"**

custom and arranged to take the youngsters to the Stoll Theatre. On February 5th, therefore, about 140 members of the company aged from 14 to 16 were given a good wartime lunch at Magnet House and afterwards proceeded to enjoy themselves with "Hi-de-Hi." Mr. and Mrs. Gamage and Lord Margesson, a director of the G.E.C., joined the party at lunch.

**Mr. Henry B. Bryans,** executive vice-president of the Philadelphia Electric Co., has been elected president of the American Standards Association.

**Sir Summers Hunter,** honorary Regional Director of Merchant Shipbuilding and Repairs has been nominated for the presidency of the North-East Coast Insitution of Engineers and Shipbuilders. There are no other nominees.

On Tuesday last Lord Inverforth and the directors of Cable & Wireless, Ltd., entertained the chairman, **Sir Edward Wilshaw,** to luncheon to mark his completion of fifty years' connection with overseas telegraph communication. He was presented with his portrait painted by Mr. Frank Salisbury.

**Mr. J. B. Mavor** and **Sir Frederick C. Stewart,** K.B.E., have joined the board of the North British Locomotive Co., Ltd. Mr. Mavor, a nephew of the late Mr. Sam Mavor, is managing director of Mavor & Coulson, Ltd., and Sir Frederick Stewart is chairman of Thermotank, Ltd., and of Kelvin, Bottomley & Baird, Ltd., and a director of other companies.

Wigan Electricity Committee has extended the service of **Mr. Robert Owen,** the borough electrical engineer, for another twelve months after February 22nd, when he will attain the retiring age.

**Mr. W. W. Marsh** has been appointed Controller for the Eastern Region by the Minister of Fuel and Power.

## Obituary

**Col. G. D. Ozanne.**—We learn with regret of the death, on February 12th, at the age of fifty-four, of Col. Guy D. Ozanne who, until the beginning of the war, was with Wingrove & Rogers, Ltd. Col. Ozanne was educated at Elizabeth College, Guernsey, and at Sandhurst and served in the Indian Army from 1909 to 1923, being awarded the M.C. during the last war. He was O.C. City of London Signals from 1930 to 1935 and was later Deputy Chief Signal Officer.

From 1924 to 1926 Col. Ozanne was with the Radio Communication Co., joining Wingrove & Rogers, Ltd., in the latter year. He had served as chairman of the Electric Vehicle Association and of the Radio Component Manufacturers' Association and on the Council of the Radio Manufacturers' Association. During the past four years he had been employed on special military duties. He was a member of the Institution of Electrical Engineers. The funeral took place at Old Charlton Cemetery on Wednesday.

**Mr. R. Armitage.**—We regret to report the death on February 10th of Mr. Robert Armitage, a director of the Yorkshire Electric Power Co. and its associated concerns. Mr. Armitage had been chairman of the company but resigned on medical advice in 1939, when he became joint deputy chairman, a position which he gave up in 1942, although he remained on the board. Mr. Armitage was prominent in public affairs for many years; he was Lord Mayor of Leeds in 1904-5 and represented Central Leeds in Parliament for sixteen years. He was seventy-seven years of age.

**Mr. E. Schattner.**—The death occurred on February 12th, at his home, Wildwood Road, N.W.11, of Mr. Ernest Schattner, M.I.E.E., M.Am.I.E.E., at the age of sixty-four. Mr. Schattner was founder and a director of the Schattner Electricity Meter Co., Ltd., the Electrical Apparatus Co., Ltd., and Electrical Utilities, Ltd. (old company), and a director of Electrical and Engineering Development Ltd.

**Mr. Albert Tubbs,** Luton manager of the Alliance & Surrey Wholesale, Ltd., died on February 7th in Luton Hospital after a short illness. He had been with the company for over twenty years, previous to which he was with Veritys, Ltd.

**Mr. E. Carden,** manager of the Dover Corporation Tramways Department from 1897 to 1919, died recently at West Dulwich at the age of eighty-one.

**Mr. A. Ramsay Lamb,** formerly district manager Post Office Telephones, for Chester, North Wales, Shrewsbury and Stoke-on-Trent, died on February 12th at the age of seventy-seven.

**Dr. A. Stansfield.**—The death occurred in Montreal on February 5th of Dr. Alfred Stansfield, F.R.S.C., A.R.S.M., Emeritus Professor of Metallurgy at McGill University; he was seventy-two. Dr. Stansfield reported to the Canadian Government in 1914 on the electric smelting of ores, after a visit to Sweden, and shortly afterwards carried out much experimental work in the electric smelting of zinc ores and titaniferous ores of iron.

**Will.—Col. S. E. Smith,** former director and general manager of the Bristol Tramways Co., Ltd., left £370,745 (net £343,938).

## Contractors' Notes

MR. L. C. PENWILL, director and secretary of the Electrical Contractors' Association, has notified his members of an arrangement which has been devised, for securing uniformity in the method of paying employees. It is proposed that the pay week shall finish at stopping time on Saturday and time sheets made up to that time. Men will receive their pay for any week on the following Thursday or Friday, giving the wages department about four days in which to prepare wage statements and pay packets. It will be seen that by this arrangement the men will receive pay for an incomplete week for the first week. To avoid any hardship it is recommended that advance payment shall be made to bring up the amount to that for a normal 47-hour week, the advance being refunded over the next four weeks or mutually acceptable period.

Similar arrangements are being made in other industries and the Electrical Trades Union has offered no objection to the proposal.

### "Pay as You Earn" Tax

Mr. Penwill draws members' attention to a modification of the scheme for the deduction of income tax from earnings which has been permitted by the Board of Inland Revenue as the result of representations by the British Employers' Confederation. By this the deduction of tax will be made weekly by reference to simple non-cumulative tables, a separate table being used for each code, with an adjustment after the end of a maximum of three weeks so that the total tax deducted up to date is brought into line with the full cumulative tax tables, the adjustment being made in the wages for the following week.

### Young Electricians' Wages

Electrician apprentices and other workers under twenty-one years of age in the electrical contracting industry are paid rising percentages of the journeyman's rate according to their category, age and grade. To assist employers and employees it has been agreed by the industry's National Joint Industrial Council to issue from time to time a statement showing the actual hourly rates payable to these young workers (exclusive of the war addition), instead of leaving the calculations to be made by the employers.

### Progress Payments

In the E.C.A. Conditions of Tender and Contract it is provided that progress payments if applied for shall be made to the extent of 80 per cent. of the work done and material delivered to the site from time to time until the retention amounts to 10 per cent. of the agreed contract (less any provisional sums) after which payments are to be made in full. The figure of 80 per cent. has now been amended to 90 per cent.

# Wattmeter-Relay Protection

## *Isolation and Indication of Earth Faults*

HOW earth faults on a distribution system protected by Petersen coils may be automatically isolated, or indicated, by means of super-sensitive relays of the wattmeter type is explained by Messrs. L. B. S. Golds (Edmundsons Electricity Corporation, Ltd.) and C. L. Lipman (Nalder Bros. & Thompson, Ltd.) in a paper contributed to the Measurements Section of the Institution of Electrical Engineers.

After discussing the principle on which this kind of protection is based and enumerating the electrical constants of the system to which the method is applied, the authors describe the application of this type of relay to a 66-kV distribution network. Feeder currents are analysed to enable the problem of their accurate summation to be discussed in detail. Results are indicated of laboratory tests on current transformers at small percentages of their rated figures, approximating to their capacitance currents. A comparison is made between current totalising by means of a summation transformer and by direct paralleling, while further test figures indicate the effect of load current in addition to capacitance currents.

### Operational Experience

The design of the measuring element of the relay, which comprises a fixed electromagnet and a moving system of the two-part rotor type, is described with particular emphasis on its constructional features and operating characteristics. The authors conclude from experience gained in operational practice, both on tests with artificial faults and under actual earth-fault conditions, that these relays are perfectly reliable, provided that the equipment has been connected correctly and that the current transformers are sufficiently accurate. In the last-mentioned respect transformers with "Mumetal" cores have been of great assistance.

The Wessex Electricity Co., the South Wales Electric Power Co. and the Cornwall Electric Power Co. co-operated in carrying out the tests.

It is pointed out that when the gear is being newly commissioned an artificial fault is valuable for proving the reliability of the equipment. By observing the operation of the relays at each substation with faults at selected points the complete scheme can be put into operation with the minimum of testing. Preliminary tests are made by injection, single and three-phase, to ensure that the transformers are balanced and that they comply with specifications.

It is not suggested that finality in design of this form of protection has been reached, but with the increasing use of Petersen coils this method of selectively tripping faulty lines under certain circumstances may be of service. The super-sensitive relays, which are a development of the "Group A" previously described by Mr. C. L. Lipman for AC systems (*I.E.E. Journal*, 1931-32, Vol. 70, p. 545), are already being used in conjunction with phase-fault relays to switch out one faulty line in the event of a double earth fault, leaving the original fault on the system.

The difficulty of extreme sensitivity has been overcome by the use of a resistance in series with the coil, which serves the dual purpose of limiting the asymmetric current under healthy conditions and also of increasing the active component under fault conditions. This feature is advantageous in that it makes the relay more robust, although the basic principles still apply in operation.

## Space Heating in Canada

MR. H. Massue, statistical engineer of the Shawinigan Water & Power Co., expressed the opinion in an address to the Electrical Club of Montreal that under the climatic conditions in the province of Quebec the heating of private dwellings by electricity by present methods was not economic. Electricity would be ideal for heating but the factors against it were the magnitude of the power requirements, the investment needed, the limited time during which the full capacity of the installation would be used, and the high cost of heating which would result. The electric heating of private dwellings would increase the power requirements of retail customers tenfold. There were only three provinces in which water-power resources would be sufficient to meet heating requirements of private dwellings, namely, Quebec, British Columbia and Manitoba. To produce heat for private dwellings in Montreal would require seven Beauharnois plants utilising the 82-ft. head available between Lake St. Francis and Lake St. Louis, and containing 13 units of 53,000 HP each. With general electric heating the charges would be altogether too high for the ordinary house owner to pay. As time went on more and more electricity would be used for heating, but it would only be as auxiliary to coal, oil and gas.

## I.E.E. Report on Post-War Supply

THE I.E.E. Post-War Planning Committee's report on "Electricity Supply, Distribution and Installation" (*Electrical Review*, February 4th) is to be published in the March number of Part I of the Institution *Journal*. For members who do not receive this part of the *Journal*, or who particularly require the report separately, a limited supply of copies are available on application to the secretary.

# COMMERCE and INDUSTRY

## *Cinema Propaganda. Norwich Aids Consumers.*

### A.E.U. Conferences

THE Amalgamated Engineering Union is for the first time to convene a conference of engineering apprentices and youths to be held at Southport on July 20th and 21st. The delegates, who will represent all the divisions in the country, must be over 18 and under 21 and have at least twelve months' membership of the Union. It is understood that women between the same ages will be eligible. The second annual national conference of women members of the Union is to be held at Leicester on May 4th and 5th. Last year's was the first of its kind called by any union and aroused considerable interest. The National Committee—the governing body of the Union—meets in Edinburgh from July 12th to 17th.

### A.S.E.E. Annual Luncheon

The Association of Supervising Electrical Engineers is holding its annual luncheon and reunion at the Connaught Rooms, Great Queen Street, London, W.C.2, on Saturday, March 11th, at 12.30 for 1 p.m. The president of the Association, Mr. H. W. Swann, M.I.E.E., will be in the chair. A limited number of tickets (price 10s. 6d., including gratuities) is available from members or from the general secretary of the Association, Aldwych House, W.C.2.

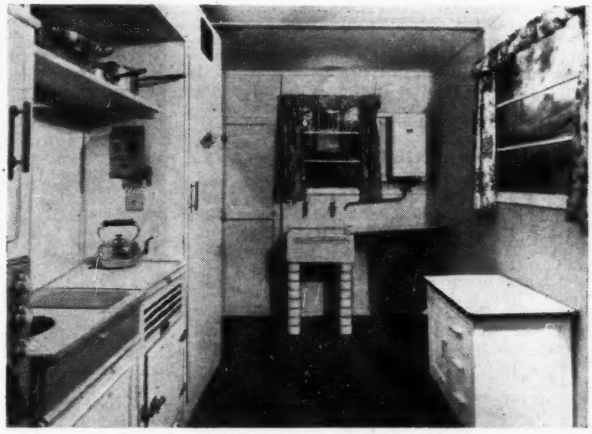
### New E.D.A. Film

As its latest contribution to the Fuel Economy Campaign, the British Electrical Development Association has just completed a new five-minute film entitled, "Too Easy," featuring Jeanne de Casalis as "Mrs. Feather" and "Her Better Self." This is the first film produced by E.D.A. since the early days of the war and, being intended for showing to the general public, is in rather a lighter vein than previous productions. As Mr. V. W. Dale, assistant director and secretary of the Association, explained at a preview last week, its three main objects are to emphasise that coal is necessary for generating electricity, to demonstrate the various ways in which electricity is wasted in the home, and to show how meters can be read.

The irresponsible Mrs. Feather provides an admirable means of "getting this across," her better self pointing out how easy it is to waste electricity by switching on radiators when they are not really needed, by using too much hot water for the bath, by ironing only one article instead of waiting till there are several to be done, by filling the kettle to obtain only a little hot water, by not using the cooker intelligently, and by having more lights on than are required. It is hoped that this film will be the forerunner of a series and Mr. Dale mentioned that two other films now being prepared will deal with large-scale cooking and post-war housing. A further film, a "documentary," Mr. E. E. Hoadley, chairman of E.D.A., told us, will be a historical record of the part played by electricity in the prosecution of the war.

### Norwich Consumers' Advice Bureau

As mentioned in our issue of November 19th, the Norwich Corporation Electricity Department has leased shop premises in the main market square and equipped them as a Consumers' Advice Bureau. After the counters and shelves, etc., had been removed the inside of the shop was given a cheap decoration and equipped with furniture and floor covering taken from other premises belonging to the undertaking, the walls being covered with posters from E.D.A., the Ministries of Food, Fuel and Power, etc. A "Make Do and Mend" section gives examples of misused apparatus, alongside new parts, together with short written explanations of the types of abuse that cause failure of apparatus, and hints and tips on avoiding misuse. Another section indicates small repairs that consumers can do themselves, and a large-scale model shows how to read a meter.



**Model kitchen at the Norwich Consumers' Advice Bureau**

To cater for present needs of those consumers who want to improve their existing facilities,

various modern items of apparatus are displayed, including an "Essex" grinder with examples of the products obtained and details of its cost and consumption. A number of Moffat cookers suggest the type of equipment which it is hoped to make more generally available when conditions improve.

A model kitchen suitable for an artisan's house contains a unit similar to those produced by other undertakings, and has been laid out with consideration for full labour-saving in the location of apparatus and furniture. Visitors are asked for their comments upon the lay-out and some useful suggestions have been received. The equipment has been built up from reconditioned materials and a further kitchen is now being made which will illustrate the undertaking's ideas for better-class property. Visitors to the bureau, numbering between 150 and 200 per day, come from all parts of Norfolk.

## Draughtsmen's Claim Fails

A series of four awards (Nos. 501-4) has been made by the National Arbitration Tribunal in which members of the Association of Engineering and Shipbuilding Draughtsmen asked for higher salaries to be paid by their employers—the British Thomson-Houston Co., Ltd., the English Electric Co., Ltd., the General Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd. The applicants asked that their salaries should be brought up to the general level of those paid to draughtsmen throughout the country and that the adjustments should be made retrospective to January 22nd, 1943. Evidence was given regarding salaries paid to draughtsmen in the engineering industry, the organisation of drawing office work and other relevant matters. The awards, which are in identical terms, state that after hearing the statements of both parties in each case the Tribunal finds that the claims have not been established.

## Americans Entertain British Workers

Employees of the Norwich works of Laurence, Scott & Electromotors, Ltd., were the first all-civilian audience to be entertained by a company formed from the United States Eighth Air Force. About seventy instrumentalists, singers and artists gave an entertainment in the canteen which packed into 40 minutes some of the "high spots" from a show which is being presented at theatres in England to U.S. Forces. The company has been got together within the last few weeks but performs with professional "slickness." All the members are operational soldiers.

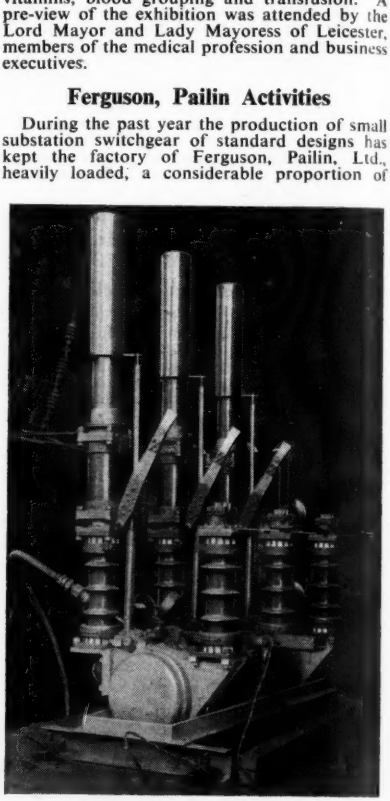
The officer in charge, Lieut. Brest, stated that he was glad to have the opportunity of trying out the show before an all-English audience, which showed that it could understand the language and appreciated this opportunity of furthering Anglo-American relationships.

## Health in Industry Exhibition

For the benefit of the factory war-workers under their management, Partridge, Wilson & Co., Ltd., held a health exhibition in Leicester last week in conjunction with the Central Council for Health Education and the Ministry of Information. It was sponsored by the Leicester Industrial Health Advisory Council the Dental Board, London, the City of Leicester Health Department, the Leicester Royal Infirmary and the Leicester Blood Transfusion Service. Volunteers from the medical, dental and nursing professions gave information and advice and the subjects dealt with, by display, leaflets and professional advice included diet, rest and sleep, exercise, scabies and other infestations, venereal diseases, teeth, feet, vitamins, blood grouping and transfusion. A pre-view of the exhibition was attended by the Lord Mayor and Lady Mayoress of Leicester, members of the medical profession and business executives.

## Ferguson, Pailin Activities

During the past year the production of small substation switchgear of standard designs has kept the factory of Ferguson, Pailin, Ltd., heavily loaded, a considerable proportion of the output being for export, for which purpose a number of 33-kV and 120-kV outdoor circuit-breakers and heavy-current indoor circuit-breakers have also been provided.



**33-kV air-blast circuit-breaker**

Contracts for modernising existing switchgear have included the fitting of cross-jet explosion pots in order to increase their short-circuit ratings. Designs for 33-kV, 66-kV and 132-kV air-blast breakers have been subjected to short-circuit tests to ensure that they are sound practically as well as technically.

The range of application of the 25-A rotary switch for voltages up to 600 has been extended to include the control of multi-speed machine-tools by the pole-changing method and up to four-way multi-pole circuit selection.

In the range of medium-voltage 150- to 1,200-A 25-MVA metalclad switchgear, draw-out circuit-breakers are now available mounted on the front of small cubicles which contain the busbar cable box and current transformers.

Designs for spring-closing mechanism have recently been completed in which a motor rewinds the springs so as to allow for automatic or remote control by supervisory or other means. The energy taken by the reloading motor is small and it can be driven from an auxiliary AC supply or from a small tripping battery.

## Argentine Nationalisation Report

It is reported from Washington by *Reuter's Trade Service* that the report of the special committee appointed by the Argentine Minister of the Interior, which has been studying the nationalisation of all privately-owned telephone companies in Argentina, is to be submitted next month. The immediate target of the proposed Argentine move is said to be Argentina's second largest public utility system, the Union Telefonica, a subsidiary of the International Telephone & Telegraph Co.—whose investments in Argentine telephone properties total more than $87 million. Particular concern has been caused by the belief that nationalisation of the telephone system is merely a prelude to a wider programme by the Argentine Government aimed at nationalising all foreign-owned public utilities.

## Contract Price Adjustment Formulæ

The British Electrical and Allied Manufacturers' Association notifies us that the latest figures for use in its contract price adjustment formulæ are as follows: (a) Rates of pay.—The rate of pay for adult male labour at February 12th shall be deemed to be 86s. 6d. (b) Costs of material.—The index figure for intermediate products last published by the Board of Trade on February 12th is 172·8 and is the figure for the month of January, 1944.

## Radio Research

The formation of a British Radio Research Institute is recommended in a report prepared by the British Institution of Radio Engineers. It is proposed that the Institute should be financed in equal proportions by the Government and the industry and that it should be directed by a board representative of Governmental authorities, the industry, the British I.R.E. and associated professional institutions and Empire universities.

## Fatalities

**Flex Extension.**—At an inquest held at Newport on a woman who was found dead at her home it was stated that her arm apparently touched a flex connecting an electric fire with a lamp socket. A piece of 2-A flex had been used as an extension to a length of 5-A flex. Mr. E. J. Stevens, of the Newport Corporation Electricity Department, said that it was essential that electrical fittings used in a bathroom should be properly installed.

**Lighting Plant in Farm-shed.**—It was stated at an inquest on a 16-year-old boy who was found dead in a Gloucestershire farm-shed where an electric lighting plant was installed that the voltage of the dynamo was only 50. A doctor expressed the opinion that this would be sufficient to cause death in the circumstances, as the floor was very wet and the boy's trousers, rubber boots and hands were also wet.

## Electrician's Pocket Book

There has been little reduction in the size of the "Practical Electrician's Pocket Book" for 1944. Apart from necessary revisions there are some additions including chapters on "Electronics in Industry," "Wiring for Sound Distribution," "Bell and Alarm Circuits" and a general-reference introductory chapter on "Electricity and Magnetism." The pocket book is published at 3s. 6d. net by *Electrical Trading*, 92, Long Acre, W.C.2.

## Electrically-Propelled Vehicles

Figures given by Mr. Noel Baker in the House of Commons last week showed that 7,522 goods vehicles, 91 private cars, and 13 motor cycles and invalid chairs—a total of 7,626 vehicles—were licensed to run on electricity at the end of last year.

## Keighley Lifts

In our issue of December 31st we reported that Keighley's (Lifts & Motors), Ltd., had been struck off the Register of Companies. The Keighley Electrical Engineering Co. (briefly known as "Keighley Lifts") write to tell us that the company in question was merely a subsidiary of theirs which had never been actively worked; they themselves are still functioning as electric lift manufacturers. We are glad to clear up any misunderstanding there may have been.

## Consumer Fined

A fine of £40, with £4 2s. 6d. costs, was imposed at Stoke Stipendiary Court on February 4th, on Matthew Kelly, electrician, 14, Long Lane, Harriseahead, for fraudulently consuming electricity. For the North-West Midlands Joint Electricity Authority, Mr. F. Mee said that when a mains assistant visited defendant's house to change a meter on December 7th he found a one-kilowatt fire being fed by a wire which had been inserted to by-pass the meter. Defendant, who pleaded not guilty, denied all knowledge of the wire. It was stated that he had several previous convictions, including theft charges.

## Jet Propulsion

In the course of a letter to *The Times* upon the development of jet-propelled aircraft, Sir Maurice Bonham Carter says that the first experimental engine to Group Captain Whittle's design was built to the order of Power Jets, Ltd., by the British Thomson-Houston Co. and brought to successful preliminary test in 1937.

## Miniature Soldering Iron

In the description of this soldering iron published in the *Electrical Review* of February 4th (pp. 169-70) some errors crept in. The packing of the heating element is magnesium *oxide* and it is enclosed in an alloy, not a copper, tube.

## Trade Announcement

S. O. Bowker, Ltd., have moved to 19-21, Warstone Lane, Birmingham, 18.

# Insulating Varnishes

## *A Guide to Selection and Application*

By R. McGill

(*Managing Director, Sterling Varnish Co., Ltd.*)

***Details are given of the varieties of insulating varnishes at present available, with notes to assist in making the most of their excellent dielectric and protective properties, particularly in conjunction with absorbent insulators***

A FILM of varnish of the same thickness as the fabric that is impregnated with it would have a much greater dielectric strength than that of the impregnated fabric; in other words, the varnish is the real insulator and the fibrous material is only a mechanical support for the varnish. Yet electrical engineers generally attach considerably more importance to the selection of the fibrous material than to the choice of the varnish and its application.

Clear amber oil base grades are so called because in addition to natural gums and resins with their solvents they contain a "drying" oil which may be either linseed oil or china wood oil or both. China wood oil is also known as Tung oil. The varnish sets by oxidation of these "drying" oils, and their stoving times vary from 4 to 16 hours at 100 deg. C. In general, the greater the proportion of oil content, the longer will be the life of the varnish and the greater its flexibility. China wood oil has become more favoured for this type of varnish since it has better moisture resistance and is more suitable for use under tropical conditions than those varnishes which contain linseed oil only. It is most efficacious as an "anti-tracking" finish for bakelised paper and fabric boards and tubes. This type is covered by B.S. 119 "Clear Baking Varnish for Electrical Insulation."

Bituminous oil base varieties are similar to those described above, except that they contain a proportion of bitumen in place of "resin." They have good ageing properties and are highly resistant to moisture, acids and alkalis. This type is covered by B.S. 514 "Baking Varnish (Bitumen Type) for Electrical Insulation."

Air drying varnishes as a rule have only a small amount of drying oil so as to procure quick drying. The very quick drying type contains no oil at all and has methylated spirit as a solvent; consequently this type of varnish is rather more brittle than the one containing oil. B.S. 634 covers air drying insulating varnish for electrical purposes.

Synthetic resin oil base varnishes differ from the straight bakelite type in that they incorporate drying oils and do not have a methylated spirit solvent. They are obtainable in clear amber and black and are suitable for high-speed machines because they have particularly good binding properties, durability and ageing characteristics without being brittle. In addition, they have very good oil resistance. This type of varnish gives the best results when stoved at a temperature of not less than 135 deg. C.

High-temperature varnishes have a synthetic resin oil base specially developed for use with glass insulation. They have all the excellent properties just enumerated and, in addition, do not disintegrate at temperatures below 200 deg. C. They require a stoving temperature of 130 to 150 deg. C., and are suitable for stoving by the infra-red ray method.

Core-plate grades of three kinds are in common use: the "flashing" type whose solvent is burnt off the core-plate; the spirit type whose solvent is removed by stoving (this type may contain synthetic or natural resins); and heat resisting varnishes which are of particular interest for traction work. They may be applied by spraying or by passing the plate through rollers made of felt, rubber, or gelatine kept "wet" by some means of varnish feed. Adjustable pressure on the rollers provides easy control of the thickness of varnish film applied to the core-plate.

Mica sticking varieties of three types are in general use, the most common of which is shellac. A mica sticking varnish known as "Black Bond" is sometimes used for making "Micafolium"; it has a bitumen base and is mainly used in large turbo-generators. It is claimed to have better power-factor/temperature characteristics than "Micafolium" made with shellac. A third type with clear oil base is usually employed in the manufacture of silk-mica or paper-mica tapes.

### Care of Varnish

Impurities must not enter the varnish tank. Viscosity should be checked regularly and the correct fluidity maintained by adding "thinners" of the correct grade. A high proportion of trouble is due to the unsuspected rise in viscosity which results from evaporation of the volatile constituents. Incorrect viscosity can cause incomplete penetration and failure to dry out satisfactorily under the prescribed baking temperature and time. In many modern varnishes the specific gravity of the thinners is not greatly different from that of the varnish. It is therefore possible to add a very great proportion of thinners without appreciably affecting the

gravity of the mixture. Such conditions would, of course, seriously affect the amount of " body " in the varnish and its value as an insulator. Viscosity checks are strongly recommended.

### Pre-Drying

Before treating insulated windings or fibrous material it is necessary to dry them out thoroughly in an oven, usually steam or electrically heated, which is ventilated by natural draught induced by careful design of the oven, or in a lagged chamber into which hot air previously dried (usually by means of silica gel) is passed. It is usual to pass the dry air through the oven chamber to atmosphere and then, in the later stages of drying when most of the moisture has been removed from the article, the air may be circulated in a closed system to conserve heat and the silica gel. This method of pre-drying is very efficient and much quicker than ordinary oven drying.

Vacuum drying under the influence of heat is employed when extreme dryness is required, or when the shape of the article makes drying-out difficult, *e.g.* very deep coils, coils with many interlayer fibrous insulations, or coils with outside taping.

Where " site " drying is necessary, or large parts cannot be accommodated in conventional ovens, infra-red heat drying appears to be a solution as it can be " taken to the job."

### Varnish Treatment

Of two methods of treatment in general use the " dry, dip and bake " procedure is satisfactory for stators, armatures, field coils, etc., where the windings are not exceedingly deep or tight. It is used by many manufacturers and most repairers and is also useful when coils have to be formed after varnish treatment and, as in transformers, the actual impregnant will be oil; but a varnish dip is given for mechanical reasons, to keep the coils clean and dry during handling and to anchor down the fibres of the insulation to avoid detachment with consequential deterioration of the electric strength of the oil. The " dip and bake " method is also used with enamelled wire.

Dipping must be carried out immediately the article is removed from the pre-drying oven, the time of immersion depending upon the viscosity and the penetration of the varnish, and also the depth and size of winding. It should not be overlooked that the hot article being dipped raises the temperature of the varnish in contact with it and thus reduces its specific gravity and viscosity considerably. This increases penetration, but if the article is still hot while draining after dipping, only a thin coat of varnish will be left on the fibrous insulation and a considerable amount of that absorbed into the fibrous insulation will drain away. It thus appears necessary to give a second dip. If the article is allowed to cool down almost to room temperature before the second dip is given a thicker coat of varnish will adhere which, when baked, will form a more moisture-resistant film. It is advisable to drain and bake the second coat in the reverse direction to that in which the first coat has been baked.

When windings and coils need to be stiffened mechanically, or are deep, taped on the outside, or have fibrous interlayers, vacuum impregnation may be necessary to remove air completely (and incidentally moisture). It is not always possible to heat the impregnating pot, so the article should be placed in the pot as soon as possible after removal from the pre-heating oven and pumping should be commenced immediately so as to conserve the useful heat in the article. After an adequate period of pumping the varnish is admitted to the pot under vacuum and either the article is allowed to soak for some considerable time under atmospheric pressure, or a pressure cycle up to 100 lb. per sq. in. may be introduced. Some manufacturers prefer to apply vacuum during the subsequent draining process, but this tends to make the varnish porous and on this account is not recommended.

### Stoving of Varnishes

The first function of stoving a varnished article which has been either dipped or vacuum impregnated is to remove the solvent. It is best done at a moderate temperature of 70 deg. C., thus preventing the solvent from being trapped by surface skimming. Such preliminary stoving should be of the order of at least four hours' duration, after which the final bake can be given.

It is most essential to adhere to the varnish manufacturer's minimum stoving temperature which, for oil base varieties, is usually 90 to 110 deg. C. The attainment of the recommended stoving temperature for synthetics, which is usually 130 to 150 deg. C., is very necessary to ensure complete polymerisation and thermosetting.

During the preliminary stoving it is essential that the oven be well ventilated so as to get rid of the evolved solvent. It is also important because oil base varnish sets by oxidation, and oxygen must be provided by adequate ventilation of the oven. During the final stoving of synthetics it is not so important.

The infra-red drying of paints offers advantages over ordinary oven drying and for mass-produced parts, such as armatures for instance, would appear to enable the whole process from pre-drying to final second bake to be made entirely automatic, using a conveyor system.

The following suggested schedule could be adopted where a synthetic resin impregnating varnish is employed, this type of varnish being

the most suitable for infra-red drying. The armatures could be accommodated in a cradle designed to permit easy reversal, so as to be able to stove in the opposite direction to that of draining.

The complete cycle could then operate by passing the armatures through a bank of infra-red lamps for pre-heating at a temperature of, say, 110 deg. C., then into and through a dipping tank (this operation taking, say, five minutes) followed by a draining period of five minutes, armatures reversed, and then again passed through the stoving bank. The lamps in the bank could be so arranged as to give a quick temperature rise up to 70 deg. C., which is the usual temperature recommended for the pre-stoving of the synthetic varnishes, followed by a further quick temperature rise to 130 deg. C. which is necessary for the final bake. The armatures could then be allowed to cool to between 80 and 90 deg. C., the process being hastened by fan draught. Then could follow in sequence—dipping in varnish, draining, reversal and passage into the bank of lamps for the second bake.

It has already been established that, using a suitable varnish, the whole cycle can be completed in about six hours (small armatures), equivalent treatment on conventional lines taking not less than 24 hours.

Apprehension has been felt about the treatment of artificial silk with varnish. It has now been established that viscose, cuprammonium and "Fortisan" silks are unaffected by all normal insulating varnishes. Acetate silk is slightly under suspicion if used with varnishes employing a methylated spirit solvent. Engineers can, therefore, use artificial silk, with the one proviso mentioned, wherever they used real silk, without making any alterations in their varnish treatment schedule.

The misuse of varnish on transformer coil insulation immersed in oil has for many years been the source of much trouble, in most cases due to inefficient drying and the use of unsuitable varnishes in which case the gums and resins in the varnish go into partial solution in the oil, so accelerating the formation of sludge-like deposits on most immersed surfaces, and causing acidity of the oil. The deposit impairs the dissipation of heat from the coils which, in turn, further deteriorates the oil. Only by correct stoving of the varnish (time and temperature) can proper oil resistance be obtained.

Varnish is one of the best servants of the electrical industry, but correct selection and processing are necessary to enable it to perform this role.

# Protective Phosphate Coatings

## *Rustproofing Metal Parts*

TWO papers presented at a London meeting of the Electrodepositors' Technical Society have dealt with the history and development of phosphatising.

Messrs. R. C. Davies and S. J. Scouse (metal-finishing department, Pyrene Co., Ltd.) describe how the processes of "Parkerizing" and "Bonderizing" should be carried out for rustproofing iron and steel and for protecting galvanised steel or electro-deposited zinc or zinc base die castings from corrosion.

"Parkerizing" consists in the conversion of the surface of the metal into a non-metallic, crystalline absorbent phosphate coating, the pores of which are then filled by sealing the coating with a suitable medium, such as oil. Typical applications include the rustproofing of nuts and bolts, fittings, tools, castings, forgings, etc., and intricate mechanisms such as parts of typewriters, cameras, automatic machines, etc.

"Bonderizing" and "Spra-Bonderizing" have for their object the conversion of the surface of iron, steel, zinc, or cadmium, into a phosphate coating of such a nature as to provide a bonding surface and corrosion inhibiting base for all types of enamels, paints, varnishes, lacquers, etc. These processes are largely used for rustproofing the enamelled and finished parts of cars, cycles, refrigerators, washing machines, and electrical equipment.

For many years past separate plants have been needed for "Parkerizing" and "Bonderizing," but the development of the "D" process in recent years has provided a solution which will give a "Bonderized" coating with an immersion time of 3 to 5 minutes, while if the metal to be treated is subjected to a longer immersion time, up to as much as 30 minutes, the coating continues to develop and acquires the properties of a "Parkerized" coating. It is useful to note that no change in operating conditions or solution strength is necessary as the "D" solution will build up a more robust coating than is required as a rustproof base for paint, solely by leaving the parts in the solution for a longer time.

In another paper Mr. H. A. Holden deals with the chemical and electrochemical factors that influence the solutions in which rustproof phosphate coatings are formed on iron and steel. He points out the disadvantages of the original Coslett bath, which contained essentially phosphoric acid, and shows how they can to a large extent be avoided by the use of acid primary Zn or Mn phosphate solutions.

The various theories put forward for explaining the precipitations and composition of the coatings formed in such baths are discussed, the importance being emphasised of maintaining a fixed ratio of combined to free phosphoric acid. A brief description is included of the Machu theory, which explains the specific functions of such substances as soluble copper salts, certain oxidising and reducing agents and a miscellaneous variety of chemicals that act as accelerators of the process when added to the primary acid bath.

# ELECTRICITY SUPPLY

## *Plymouth Finances. Rate Aid at York.*

**Caterham.**—SEWAGE WORKS PLANT.—The Urban District Council has approved a scheme for the provision of electrical plant at the sewage works after the war at a cost of about £1,000.

**Cheltenham.**—HEATING OF BATHS.—The Baths Committee is in consultation with the borough electrical engineer regarding the improvement of the heating at the Alstone baths.

**Dumfries.**—DISPOSAL OF SURPLUS PLANT.—The Electricity Committee reports that £6,155 has been obtained for surplus plant at the electricity works, including £5,000 for a 1,500-kW turbo-alternator.

**Gateshead.**—HOSPITAL KITCHEN EQUIPMENT.—The Town Council is urging the Ministry of Health to agree to the installation of electric cookers in place of the gas cookers at Bensham Hospital at a cost of nearly £400.

**Jarrow-on-Tyne.**—SCHOOL LIGHTING.— The Education Committee has decided to include in its estimates £380 for improving the lighting at the Croft Terrace School.

**Lichfield.**—WATERWORKS SUPPLY.—The Electricity Committee has had a request from the South Staffordshire Waterworks Co. for an increased supply for the Seedy Mill pumping station by January 1st, 1945. In view of the expected additional bulk supply from the West Midlands Joint Electricity Authority it was agreed to provide the increased supply.

FARM SUPPLIES.—Sanction has been obtained by the Committee to provide supplies to a number of farms, and permission is further being sought to extend the mains to Ashcroft Farm, Shenstone.

**London.**—ST. PANCRAS.—The Borough Council Electricity Committee is to extend mains to Windsor House, Cumberland Market, at a cost of £175 and the Arlington Road area (£150).

**Plymouth.**—ELECTRICITY ESTIMATES.—The city electrical engineer having expressed the opinion that the preparation of the annual estimates for his Department for 1944-45 would, in the existing circumstances, present insuperable difficulties, the Finance Committee is recommending the City Council to dispense with the submission of such estimates.

**Reigate.**—UNDERTAKING'S FINANCES.—Alderman W. L. Lorkin, A.M.I.E.E., gave the Council at its recent meeting some indication of the satisfactory position of the electricity undertaking, of which Mr. C. Rowbotham, M.I.E.E., is engineer and manager. The undertaking had, he said, for the third year given a rebate to the electricity consumers; in the current year this amounted to 33⅓ per cent. He was sure that they would consider the results of the working of the undertaking highly satisfactory when it was realised how many items had increased in price, with a consequent financial burden on the undertaking. Half of the electricity staff were serving in the Forces and the cost of making up their salaries was a substantial item. He also pointed out that the electricity undertaking was the largest ratepayer in the borough. The undertaking had taken a very active part in the Government's fuel economy campaign, and as a result there had been a saving of nearly 10 per cent. in the yearly output of electricity, for which he thanked the consumers, expressing the hope that they would continue to support this appeal.

**Ross-shire.**—LOWER CHARGES.—The Ross-shire Electric Supply Co., Ltd., Dingwall, has reduced the price of electricity in its district from 9d. to 6d. per kWh.

**Salford.** — PURCHASE OF APPARATUS. — The Light, Heat & Power Committee is seeking sanction to borrow £2,000 for consumers' electrical apparatus.

**Scarborough.**—STREET LIGHTING.—The Town Council has decided against the introduction of modified street lighting.

**York.**—RATE CONTRIBUTION DECISION.—The City Council recently debated a recommendation that the electricity undertaking should contribute £13,000 in aid of the rates (the Electricity Committee had offered £8,000 and the Finance Committee recommended that this should be raised by a further £5,000). Alderman J. B. Morrell, proposing that the higher allocation should be made, stated that the undertaking had a reserve of £100,000. Alderman C. T. Hutchinson, in moving that only £8,000 should go to the rates, said that if all the profits went there would be a loss of £2,040 and next year the deficit would be £14,750. He did not think it wise to eat into reserves. Alderman Morrell, however, retorted that there was much talk of the Government taking over electricity supplies and said he was sure that the Government would not leave them their reserves. Alderman W. Cooper thought that the Council was justified in taking the profits. The amendment was lost and the recommendation that £13,000 should be given was carried.

## Overseas

**Australia.**—FIRE DAMAGE.—A fire in a store at the Bunnerong power station of the Sydney County Council destroyed cables, condenser tubes and other electrical equipment. The total value of the damage was estimated at £25,000.

**Belgium.**—10 PER CENT. CUT.—*Le Soir* publishes an Order announcing that for the ensuing year all ordinary electricity consumers may use no more than 80 per cent. of the basic amount permitted in 1941-42. This is a cut of about 10 per cent. as compared with last year. Public services, transport and craftsmen may use 90 per cent. of the basic amount.

**Canada.**—NEW TRANSMISSION LINE.—A 120-mile transmission line between Port Arthur and the Steep Rock iron mine in North-Western Ontario has been placed in service by the Hydro-Electric Power Commission of Ontario. The line will provide power to operate the pumps which will drain an estimated 100,000 million gallons of water at a rate of 300,000 gallons a minute from Steep Rock Lake preparatory to starting operations at the rich hematite iron deposits. It will also supply

power to the Ontario-Minnesota Pulp and Paper Co., Ltd., to replace power formerly generated by the company's own power plant which had to be closed before the lake could be drained. The line, constructed within six months, is of twin wooden pole construction, western cedar replacing the usual steel poles because of the scarcity of steel. The conductors came from certain lines in the Niagara System which the Commission's statement said had decreased in importance with the development of sources of power supply in Eastern Ontario.

**China.** — ELECTRICITY CONSUMPTION RESTRICTED IN SHANGHAI.—The official German news agency reports that the electricity supplies for industrial purposes in Shanghai have been restricted since last December. This has led to a reduction in working hours of Shanghai industries, especially in the smaller factories, but no unemployment has been caused as all industries have a shortage of skilled workers.—*Reuter's Trade Service.*

**United States.** — COMMONWEALTH EDISON EXTENSION.—The *Electrical World* reports that the Commonwealth Edison Co. has completed the installation of a new 147,500-kW unit in its Fisk station, Chicago. This will add only 6·6 per cent. to the net effective generating capacity of the company and its subsidiaries. Priorities for a second unit of about the same size for the Fisk station and a 50,000-kW set have been revoked.

# TRANSPORT

**Australia.** — TRAMWAY STATISTICS. — Figures published by the Commonwealth Government show that the route-mileage of electric tramways in 1942 was 570, of which some 466 miles were of standard gauge; all non-electric tramways had ceased operation. Classified by the controlling authority, 380 miles of tramways were owned and operated by the Government, 182 miles by municipalities, and 9 miles were under private direction. Equipment in 1942 comprised 3,473 cars, motors and trailers, with a seating capacity of 208,387. Nearly half of the rolling stock was employed in New South Wales (1,587 cars with a seating capacity of 111,090), followed by Victoria (803 cars), Queensland (394), South Australia (390), Western Australia (201) and Tasmania (98). The capital cost of these electric tramways in the Commonwealth has reached £26,431,215. Gross revenue has been as high as £9,452,607, with gross working expenses of £7,015,014, giving a ratio of expenditure to revenue of 74·21 per cent., the most favourable rate since 1936-37.

**Brighton.**—EXTENSION OF TIME.—The Public Utilities Committee is seeking an extension of the statutory time for the commencement of running trolley vehicles on certain routes.

**Germany.**—FREIGHT TRAMS.—*Der Angriff* states that freight trams are to be introduced in Germany because they consume less fuel than other means of transport. They are to have a special depot of their own to which goods must be brought for dispatch.

**Gosforth (Northumberland).** — TROLLEY-BUS SERVICE ?—At a meeting of the Urban District Council reference was made to the possibility of running trolley-buses into the town from Newcastle. It was stated that the matter had been discussed with the Newcastle Corporation undertaking and, while the work could not be done during the war, it had been stated that the plan would receive favourable consideration.

**India.**—TRAMWAY EXTENSION.—On November 7th last a tramway extension from Ballygunge Station to Park Circus Depot *via* Gariahat Road was opened to traffic in Calcutta. This provides an alternative route from Ballygunge to Dalhousie Square, and for which the through fares are seven pice first class and six pice second class, considerably less than a pice per mile, which, states *Indian Engineering*, must surely be a world record for economical passenger transport by electric tramway companies.

**London.** — ELECTRIFICATION OF CAMBRIDGE LINE.—Having heard that the L.N.E.R. intends to electrify the Liverpool Street to Cambridge main line as part of its post-war development, Chesthunt U.D.C. has stated that it would prefer the Churchbury line (which forms an alternative route) to be reopened from Cheshunt to Bury Street and electrified through to Liverpool Street, including the short length from Enfield Town to Bush Hill Park. Enfield Council is supporting these representations and is also asking that the Enfield Town to Liverpool Street line shall be electrified.

**New Zealand.**—TROLLEY-BUS SCHEME.—The Auckland Transport Board has adopted a recommendation of the chairman that trolley-buses shall take the place of trams on a number of routes after the war. Permission for the change is being sought from the Minister of Transport, states the *New Zealand Electrical Journal.* The Board hopes to secure 50 trolley-buses by the end of the war.

**Nottinghamshire.** — PROPOSED TROLLEY-BUS SERVICE.—The Parliamentary Committee of the County Council has decided to raise no objection to the Nottinghamshire & Derbyshire Traction Co.'s Bill by which it seeks power to institute trolley vehicle services from the terminus of the company's existing system in Ilkeston to the city of Nottingham.

**Russia.**—" METRO " EXTENSION.—As already reported, Marshal Stalin has addressed a message of congratulation to the builders of the Moscow " Metro," who have just completed the third wartime extension of the capital's tube railway system. The *Soviet Monitor* states that the new extension was completed on January 18th. It is four-and-a-half miles long, double-tunnelled, with three stations. The " Pokrovsky " extension, as it is called, completes the fifth radial " Metro " line, and also the third stage in the general plan of " Metro " construction. All the radial lines have now been completed. The next stage is to construct outer ring lines linking up the radials.

**South Shields.**—POST-WAR TROLLEY-BUS PLANS. —The Corporation Transport Committee has considered the post-war development of the transport system and has decided that, as soon as possible after the war, the tramway between Moon Street and the Ridgeway shall be converted to trolley-buses. Another 11 miles of new routes are also to be covered by trolley vehicles.

**Spain.**—TROLLEY-BUS SERVICE.—The Spanish journal *Metalurgica y Electricidad* reports that arrangements are in progress for the establishment of a service of trolley-buses between Plana and Benicasim, in the province of Castellon.

# FINANCIAL SECTION

## *Company News. Stock Exchange Activities.*

## Reports and Dividends

**Radio Rentals, Ltd.**, are to increase their capital from £250,000 to £350,000 by the creation of 400,000 5s. ordinary shares. It is not intended to offer any of the new shares for subscription at present. The annual report for the year ended August 31st last shows a trading profit, after charging an undisclosed amount written off radio sets, etc., amounting to £112,658 (against £76,590 in the previous year, after writing off radio sets £104,874). Taxation takes £89,238 (£61,500) and war damage insurance premiums £304 (£1,690), leaving a net profit of £23,116 (£13,400), plus £24,000 from tax provision at August 31st, 1942, as a result of readjustment of tax liabilities, and less additional remuneration of managing directors. Preference dividends again require £2,750 and ordinary dividends £10,000 (£5,000). A sum of £20,000 (nil) is placed to supplementary tax reserve, leaving £44,027 (£32,303) to be carried forward.

Referring to the increase in net profit, Mr. F. H. Hunt (chairman) points out that the very considerable difference results chiefly from agreement with the tax authorities as to the revised basis of writing down valuation of sets for tax purposes, and as this is retrospective a consequent improvement in standard profit for E.P.T. is shown.

**Yorkshire Electric Power Co.**—In announcing the maintenance of the ordinary dividend at 8 per cent. for the past year, the directors state that satisfactory progress was made during the year although developments had necessarily been restricted to such as had been in the national interest. The annual meeting is to be held on Monday next at Leeds and the speech of the chairman (Sir Geoffrey Ellis, Bt., M.P.) has been circulated to shareholders. In this he refers to the litigation with the Central Electricity Board in which the company was successful. Referring to remarks regarding the spate of planning schemes for the industry which he made last year, Sir Geoffrey asks the shareholders to bear in mind what private enterprise has done in the great electricity supply industry. "For years it pioneered without profit and to-day is earning no more than a just return on the risks taken and the services rendered."

**The English Electric Co., Ltd.**, is to maintain its dividend at 10 per cent. on its increased ordinary capital of £2,359,154. After providing for taxation, the profit for 1943 amounted to £419,346, as compared with £407,560 in the previous year.

**Mather & Platt, Ltd.**, announce the payment of a final dividend of 6 per cent., making 10 per cent. for the year. Last year there was also a tax-free bonus of 1 per cent. from special reserve, making 11 per cent.

**British Rola, Ltd.**—Speaking at the annual meeting on February 12th, Mr. A. L. Smith (presiding in the absence of the chairman, Mr. R. W. Cotton) referred to his visits to the United States and said that the directors were carefully considering the company's post-war activities. Satisfactory results had accrued from closer relationship with two subsidiary companies which had previously been operating in conjunction with the company.

**Cape Electric Tramways, Ltd.**, records net dividends from subsidiaries and other income amounting to £58,146 for the year ended June 30th, as compared with £49,572 in the previous twelve months. After meeting expenses, directors' fees, etc., there is a net balance of £52,740 (£44,075), to which is added £89,639 brought in. A dividend of 6 per cent. absorbs £29,473 (£24,561) and replacements £20,000 (£10,000), leaving £92,906 to be carried forward.

**The Amazon Telegraph Co., Ltd.**, reports a gross revenue of £25,172 for the year ended June 30th, as compared with £22,316 for the previous year. Expenditure totalled £29,578 (£28,371) and there was a loss of £4,406 (£6,055), making the debit carried forward £7,998 (£3,592). No satisfaction has yet been reached in efforts to collect exchange difference of £1,904 in respect of subsidies unpaid to December 31st, 1934.

**The Lightfoot Refrigeration Co., Ltd.**, records a gross profit of £76,471 for 1942, as compared with £30,079 in the previous year. After making provision for depreciation, directors' fees, interest on debentures, bank interest and premium on redemption of debentures, there remains £54,732, which reduces the debit from £116,894 to £62,162.

**Dublin United Transport Co.**—At the adjourned extraordinary meeting last week the shareholders decided to accept the Government's proposal to acquire the undertaking. For every £10 of ordinary and preference stock, the Government proposes to allot £14 10s. of 3 per cent. debenture stock guaranteed as to interest and capital.

The company has declared a final dividend of 3 per cent., again making 6 per cent. for the year.

**Richard Johnson, Clapham & Morris, Ltd.**, announce the payment of an interim ordinary dividend of 3¾ per cent. (same).

**Clarke, Chapman & Co., Ltd.**, are again paying a dividend of 12½ per cent. for the past year.

**The Consolidated Signal Co., Ltd.**, which derives its income from the Westinghouse Brake & Signal Co., states that, provided the latter's shareholders approve the payment of the dividend and bonus of 14 per cent. already announced, a dividend of 27½ per cent. will be declared on the ordinary stock (against 24 per cent. for 1942-43).

**The Philco Radio & Television Corporation of Great Britain, Ltd.**, has acquired the General Aircraft Co.'s holding of 431,000 Aero Engines deferred shares (nominal value £43,100).

**British Ropes, Ltd.**, has again declared a final dividend of 7½ per cent., making 12½ per cent. for the past year (same).

**R. B. Pullin & Co., Ltd.**, have declared a final dividend of 15 per cent. maintaining the distribution for the past year at 20 per cent.

**The Yorktown (Camberley) Gas & Electricity Co.**, has declared a final dividend of 2¾ per cent., making 5¼ per cent. for the past year.

**The Compagnie d'Electricidad de la Provincia des Buenos Aires**, reports net earnings for 1942 amounting to £187,181, as against £185,913 for 1941, less £9,730 and £2,908, respectively, for interest, commission and exchange. The dividend on the pre-preference shares is maintained at 8 per cent.

# New Companies

**Pye Telecommunications, Ltd.**—Private company. Registered February 3rd. Capital, £10,000. Objects: To acquire the rights of access to, and the use of, the results of research, design and development in telecommunication apparatus the present or future property of Pye, Ltd., Invicta Radio, Ltd., Cathodeon, Ltd., or any subsidiary or associated company of Pye, Ltd. Subscribers: C. O. Stanley, Fairstead, Long Road, Cambridge and C. A. W. Harmer, 2, Barrow Road, Cambridge. Solicitor: W. H. Kester, Montague House, Sussex Street, Cambridge.

**Rotork Engineering Co., Ltd.**—Private company. Registered February 3rd. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrically propelled and other vehicles, accessories and components, electric motors, generators, power plants and equipment; garage proprietors, motor, electrical and general engineers, etc. Directors: A. R. Andrew and Kathleen Andrew, both of Birchfield, St. Briavels, Glos; and H. C. Blandford, 53, Birchall Road, Bristol, 6. Registered office: 127, Bishop Street, Bristol.

## Company Struck off Register

The name of J.W.B. Accumulators, Ltd., has been struck off the Register and the company is thereby dissolved.

# Companies' Returns

## Statements of Capital

**Cable Covers, Ltd.**—Capital, £10,000 in £1 shares. Return dated October 8th. 1,002 shares taken up. £1,002 paid. Mortgages and charges: Nil.

**Derby Cables, Ltd.**—Capital, £200,000 in £1 shares (all ordinary). Return dated October 8th. All shares taken up. £200,000 paid. Mortgages and charges: Nil.

**Kye Electrical, Ltd.**—Capital, £25,000 in 20,000 preference shares of £1 each and 100,000 ordinary shares of 1s. each. Return dated October 8th. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges: Nil.

**Holophane, Ltd.**—Capital, £100,000 in £1 shares. Return dated October 15th. All shares taken up. £7 paid. £99,993 considered as paid. Mortgages and charges: Nil.

## Increases of Capital

**Holliday & Son (Electrical), Ltd.**—The nominal capital has been increased by the addition of £4,000 in £1 ordinary shares beyond the registered capital of £1,000.

**Holliday Hall & Stinson, Ltd.**—The nominal capital has been increased by the addition of £7,000 in £1 ordinary shares beyond the registered capital of £3,000.

## Mortgages and Charges

**M.C.L. & Repetition, Ltd.** — Debenture, charged on deeds and documents relating to freehold factory at Pool Lane, Langley, Birmingham, and the company's undertaking and other property, present and future, including uncalled capital, dated December 30th, 1943, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

**Ceiba, Ltd.**—Debenture, dated January 4th, to secure £780, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: F. W. Sprott, and others, of Mayfield, near Tunbridge Wells.

**Arthur Lyon & Co. (Engineers), Ltd.**—Assignment of certain specified contracts, dated January 17th, to secure all moneys due or to become due from the company to Martins Bank, Ltd.

**A. E. Acton-Burnell, Ltd.**—Satisfaction in full, on January 10th, of debentures authorised July 24th, 1923, and registered August 3rd, 1923, securing £2,463 18s. 7d. (Notice filed February 3rd.)

**Vortexion, Ltd.**—Assignment of proceeds of contract, etc., dated January 20th, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

**British Electricon (London), Ltd.**—Satisfaction to the extent of £300 on January 27th of debentures authorised February 28th, 1939, and registered March 3rd, 1939.

**Electro Methods, Ltd.**—Satisfaction in full on September 2nd, 1943, of mortgage dated September 14th, 1942, and registered October 3rd, 1942.

**Accumulators of Woking (1928), Ltd.**—Satisfaction in full on December 31st, 1943, of debentures authorised October 31st, 1928, and registered November 2nd, 1928, securing £8,000.

**Wessex Electrical Service Co., Ltd.**—Satisfaction in full on December 31st of £2,000 debenture dated June 4th and registered June 25th, 1942.

# Liquidations

**Dulci Electrical Co., Ltd.**, 742-3, Salisbury House, London Wall, London, E.C.2.—Liquidator, Mr. L. R. Binns, 4, Broad Street Place, London, E.C.2, released January 5th.

**J. Dyson & Co., Ltd.**—Winding up voluntarily. Liquidator, Mr. R. Russam, 38, Piccadilly, Bradford.

**Unwin-Soar, Ltd.**—Claims to the liquidator, Mr. P. Cardwell (Poppleton & Appleby), 93, Queen Street, Sheffield, 1, by February 29th.

# Bankruptcies

**W. Price** and **A. Greenburgh**, electricians, trading as W. Price & Co., 29, Russell Street, Plymouth.—First and final dividend of 5s. 7½d. in the £1, payable February 25th at the Official Receiver's Office, 1, Church Lane, Tavistock, Devon.

# CONTROL

*Oil Immersed Rotor and Stator Starter*

**Up to 50 H.P., 400/440 VOLTS**

# VERITYS LTD.

ASTON, BIRMINGHAM 6

*Sales Headquarters :*
**BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2**

**Maintenance more important than ever before**

*MAKE REGULAR USE OF . . .*

# MARTINDALE COMMSTONES

● Cut copper, brass and steel without clogging. Edges of every bar left clean ; no dragging of copper. Save 75% of time and cost of turning commutator in lathe. Give longer life to motors, etc.

Over 50 sizes in stock, in 3 grades: coarse, medium and fine. 20 different types of handle.
Over 25,000 regular users all over the world.

**MARTINDALE ELECTRIC Co LTD WESTMORLAND ROAD, LONDON, N.W.9**

*Phone : Colindale 8642-3* *Grams : Commstones, Hyde, London*

ESTABLISHED OVER HALF A CENTURY

Goltone REGD

# CABLES
# WIRES
# FLEXIBLES

*Accessories for the . . . . . Electrical, Radio, Aircraft, Automobile & Allied Industries*

INSULATED CONDUCTORS OF EVERY DESCRIPTION FOR ALL PURPOSES

**The following publications of our manufactures are available on request :—**

**"W" Cables, wires, flexibles.**
**"B" Electrical accessories.**
**"A" Automobile wires and accessories.**
**"R" Radio wires and accessories.**
**"S" Moulded translucent shades.**

**Requirements for National Service, Emergency and Export, receive attention in order of urgency.**

Goltone
REGISTERED TRADE MARK
ESTAB: 1892

WARD & GOLDSTONE LTD. PENDLETON, MANCHESTER, 6.

# STOCKS AND SHARES

TUESDAY EVENING.

THE strength shown by prices of British Government and other gilt-edged securities is standing out prominently in to-day's Stock Exchange markets. Next month will see the opening of the campaign for "Salute the Soldier" subscriptions to war loans, but the prospect of this appeal is having no effect upon an investment demand that continues to expand with almost every business day. The Home Railway dividend season has opened with the London, Midland & Scottish announcement. The London Passenger Transport Board is expected to announce its dividend on the Thursday in this week. Interest has been aroused by the announcement of increased dividends from three of the largest London gas companies.

**London Passenger Transport**

The London Passenger Transport Board is thought likely to pay 1¾ per cent. on its "C" stock, to make 3 per cent. for the year, the same as that which was distributed for 1942 and 1940 ; the 1941 dividend was 2⅞ per cent. At the present price of the stock, the return on the money comes to a trifle over 4½ per cent., which, by the way, compares with 7⅛ per cent. afforded by London, Midland & Scottish ordinary at its current quotation.

**Fluctuations in Prices**

Hopkinsons are a good market, rising ⅛ to 61s. 3d. Mather & Platt similarly improved, to 56s. 3d. Advances of 1s. lifted Telegraph Construction & Maintenance to 52s. and Crompton Parkinsons to 28s. Lancashire Dynamo strengthened to 92s. 6d. Automatic Telephones are again better at 59s. 3d. A fall of 9d. lowered Callender's Cables to 5⅛. British Insulated and Henley's are unchanged at 5⅛ and 25s. 6d. respectively, and General Electrics hold their last week's improvement at 91s. 3d. Johnson & Phillips improved to 70s. ; Siemens at 33s. 6d. are 6d. up. The radio section shows signs of reviving activity. Cossor shares are 1s. higher at 23s. "Emi," while nominally the same as a week ago, are the subject of more attention at 27s. 6d. "Post-war television" is the slogan for to-day's speculative investor in this market. Canadian Marconis have moved up to 9s.

**Home Electricity Supply**

Renewal of investment demand has resulted in further rises in Home electricity ordinary shares. Holders of the 5 per cent. conversion stock that is being paid off in cash on May 1st are, in many cases, selling their stock now—as it is to their advantage to do—and reinvesting the money in gilt-edged industrials. The effect is seen in the way prices move up in such shares as London Electric, Midland Counties, Newcastle, Northampton, Northmet and Southern Areas. All the gains secured last week in this section are held. Mid-Cheshire Electrics are better at 38s. A number of preference issues show advances of about 6d. each.

**Overseas**

Victoria Falls Power ordinary have gone back ⅛ to 86s. 3d., there being a South African Budget statement near at hand, with the usual advance tremors of what it may contain. The Kalgoorlie Electric Power Co. is at work again after a strike which did not last for long. Calcutta Electric Supply remain at 38s., but Calcutta Trams are 1s. up at 38s. 6d. Mexican Light & Power fives have gone back two points, and bonds changed hands down to 99. Amongst other dollar stocks, Brazilian Tractions attracted New York and Montreal attention. The price is 1½ higher at 26¾, and there is talk of another possible increase in the dividend. Rio Tramway fives are up 2 at 106½. The ordinary shares of Whitehall Investments are 6d. lower at 10s. 3d.

**English Electric**

The English Electric Co. has declared its usual 10 per cent. dividend, a rate that has been paid annually for the past seven years. In the four previous years, 1933-1936 inclusive, the ordinary shares went without a dividend : for the year ended December, 1933, the company reported a deficit of £179,000. The profit for the year just ended of £419,300 makes a striking contrast to the results of ten years ago. The ordinary share capital then was £1,443,000 ; to-day it is £2,359,000. It will be remembered that the company acquired a controlling interest in D. Napier & Son, Ltd. The directors' opinion that association with this very old established company would provide greater scope for advancement in the activities of both companies has been fulfilled, and there seems no reason to suppose that the 10 per cent. dividend will be the limit of distribution after the war.

**Miscellaneous Matters**

British Electric Traction deferred is up 30 to 1115. Recent buying is based upon rumours that the B.E.T. subsidiaries are doing wonderful business in the provinces. To-day's compulsory traveller will probably find no difficulty in crediting the rumours. Cable and telephone issues are firm. Anglo-Portuguese Telephones at 24s. 6d. are the pence better. Cable & Wireless ordinary is nearly 80 : Anglo-American Telegraph preferred at 117 shows a point rise. On the other hand, Great Northern Telegraphs at 20½ continue their decline.

Argentine politics having taken a more

(*Continued on page* 247)

# ELECTRICAL INVESTMENTS

## *Prices, Dividends and Yields*

| Company | Dividend: Previous | Dividend: Last | Middle Price Feb. 15 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|
| **Home Electricity Companies** | | | | | |
| Bournemouth and Poole | 12½ | 12½ | 62/6 | .. | 4 0 0 |
| British Power and Light | 6 | 7 | 33/– | .. | 4 4 10 |
| City of London | 7 | 7 | 28/6 | .. | 4 18 3 |
| Clyde Valley | 8 | 8 | 42/– | .. | 3 16 0 |
| County of London | 8 | 8 | 41/6 | .. | 3 17 0 |
| Edmundsons: | | | | | |
| 7% Pref. | 7 | 7 | 34/– | .. | 4 2 4 |
| Ord. | 6 | 6 | 29/– | .. | 4 2 9 |
| Elec.Dis.Yorkshire | 9 | 9 | 45/– | .. | 4 0 0 |
| Elec. Fin. and Securities | 12½ | 12½ | 55/– | .. | 4 11 0 |
| Elec. Supply Corporation | 10 | 10 | 47/– | .. | 4 5 0 |
| Isle of Thanet | Nil | Nil | 18/– | .. | — |
| Lancs. Light and Power | 7½ | 7½ | 37/– | .. | 4 1 1 |
| Llanelly Elec. | 5½ | 6 | 25/– | .. | 4 16 0 |
| Lond.Assoc.Electric | 4 | 3 | 24/– | .. | 2 10 0 |
| London Electric | 6 | 6 | 29/– | +1/– | 4 2 9 |
| LondonPowerRed. Deb. | 5 | 5 | 104½ | .. | 4 15 7 |
| Metropolitan E.S. | 8 | 8 | 42/– | .. | 3 16 0 |
| Midland Counties | 8 | 8 | 41/– | +6d. | 3 18 0 |
| Mid. Elec. Power | 9 | 9 | 44/– | .. | 4 3 9 |
| Newcastle Elec. | 7 | 7 | 31/6 | +6d. | 4 9 0 |
| North Eastern Elec.: | | | | | |
| Ordinary | 7 | 7 | 34/– | .. | 4 2 4 |
| 7% Pref. | 7 | 7 | 35/– | .. | 4 0 0 |
| Northampton | 10 | 10 | 48/6 | +6d. | 4 2 4 |
| Notting Hill 6% Pref. (£10) | 6 | Nil | 11 | .. | — |
| Northmet Power: | | | | | |
| Ordinary | 7 | 7 | 39/– | +6d. | 3 11 10 |
| 6% Pref. | 6 | 6 | 30/6 | .. | 3 18 8 |
| Richmond Elec. | 6 | 6 | 26/– | .. | 4 12 4 |
| Scottish Power | 8 | 8 | 40/6 | .. | 3 19 0 |
| Southern Areas | 5 | 5 | 23/– | +6d. | 4 7 0 |
| South London | 7 | 7 | 27/– | .. | 5 3 8 |
| West Devon | 5 | 5 | 23/6 | .. | 4 5 0 |
| West Glos. | 4½ | 3½ | 24/– | .. | 2 18 4 |
| Yorkshire Elec. | 8 | 8 | 43/-xd | .. | 3 14 5 |
| **Overseas Electricity Companies** | | | | | |
| Atlas Elec. | Nil | Nil | 5/9 | .. | — |
| Calcutta Elec. | 7* | 6* | 38/– | .. | 3 3 2 |
| Cawnpore Elec. | 10 | 10 | 35/– | .. | 5 14 3 |
| East African Power | 7 | 7 | 33/– | .. | 4 4 10 |
| Jerusalem Elec. | 7 | 5 | 28/6 | .. | 3 10 2 |
| Kalgoorlie (10/–) | 5 | 5 | 10/– | .. | 5 0 0 |
| Madras Elec. | 4* | Nil | 23/6 | .. | — |
| Montreal Power | 1½ | 1½ | 23 | –1 | 6 10 5 |
| Palestine Elec."A" | 4* | 5* | 40/3 | .. | 2 9 10 |
| Perak Hydro-elec. | 6 | 7 | 10/– | .. | — |
| Shawinigan Power | 83cts. | 90cts. | 17 | .. | — |
| Tokyo Elec. 6% | 6 | 6 | 19 | +1 | — |
| VictoriaFallsPower | 15 | 15 | 4¼ | –¼ | 3 9 7 |
| Whitehall Inv.Pref. | — | 6 | 24/– | .. | 5 0 0 |

| Company | Dividend: Previous | Dividend: Last | Middle Price Feb. 15 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|
| **Public Boards** | | | | | |
| Central Electricity: | | | | | |
| 1955-60 Civil Defence) | — | 2 | 100 | .. | 3 0 0 |
| 1955-75 | 5 | 5 | 116 | +1 | 4 6 2 |
| 1051-73 | 4½ | 4½ | 107 | .. | 4 4 1 |
| 1963-93 | 3½ | 3½ | 104 | +1 | 3 7 4 |
| 1974-94 | 3½ | 3½ | 101 | +1 | 3 4 6 |
| London Elec.Trans. Ltd. | 2½ | 2½ | 97 | .. | 2 11 3 |
| London & Home Counties1955-75 | 4½ | 4½ | 112 | .. | 4 0 4 |
| Lond.Pass.Trans.: | | | | | |
| A | 4½ | 4½ | 120½ | .. | 3 14 8 |
| B | 5 | 5 | 121½ | +1 | 4 2 4 |
| C | 2½ | 3 | 66 | .. | 4 11 0 |
| WestMidlandsJ.E.A. 1948-68 | 5 | 5 | 109 | .. | 4 11 9 |
| **Telegraph and Telephone** | | | | | |
| Anglo-Am. Tel.: | | | | | |
| Pref. | 6 | 6 | 117 | +1 | 5 2 5 |
| Def. | 1½ | 1½ | 28 | .. | 5 7 2 |
| Anglo-Portuguese | 8 | 8 | 24/6 | +6d. | 6 10 7 |
| Cable & Wireless: | | | | | |
| 5½ Pref. | 5½ | 5½ | 113 | .. | 4 17 0 |
| Ord. | 4 | 4 | 79½ | +½ | 5 0 8 |
| CanadianMarconi$1 | Nil | 4cts. | 9/– | +6d. | — |
| Globe Tel.& Tel.: | | | | | |
| Ord. | 8½* | 5* | 36/6 | .. | 2 14 9 |
| Pref. | 6 | 6 | 30/– | .. | 4 0 0 |
| Great NorthernTel. (£10) | Nil | Nil | 20½ | –1 | — |
| Inter. Tel. & Tel. | Nil | Nil | 16 | .. | — |
| Marconi-Marine | 7½ | 7½ | 33/– | .. | 4 11 0 |
| Oriental Tel. Ord. | 16 | 10 | 44/– | .. | — |
| Telephone Props. | 6 | Nil | 17/– | .. | — |
| Tele.Rentals(5/–) | 10 | 10 | 11/6 | .. | 4 7 0 |
| **Traction and Transport** | | | | | |
| Anglo-Arg.Trans.: | | | | | |
| First Pref. (£5) | Nil | Nil | 2/6 | .. | — |
| 4% Inc. | Nil | Nil | 8 | +1 | — |
| Brit.Elec.Traction: | | | | | |
| Def. Ord. | 45 | 45 | 1115 | +30 | 4 0 7 |
| Pref. Ord. | 8 | 8 | 175 | .. | 4 11 5 |
| Bristol Trams | 10 | 10 | 52/6 | .. | 3 16 2 |
| Brazil Traction | $1 | $1½ | 26½ | +1½ | 6 16 6 |
| Calcutta Trams. | 5½ | 6½ | 38/6 | +1/– | 3 7 5 |
| Cape Elec. Trams | 5 | 6 | 26/– | .. | 4 12 4 |
| Lancs. Transport | 10 | 10 | 44/3 | .. | 4 10 4 |
| Mexican Light: | | | | | |
| 1st Bonds | 5 | 5 | 100½ | –2 | 4 19 7 |
| Rio 5% Bonds | 5 | 5 | 106½ | +2 | 4 13 9 |
| Southern Rly.: | | | | | |
| 5% Prefd. | 5 | 5 | 77½ | .. | 6 9 0 |
| 5% Pref. | 5 | 5 | 119 | .. | 4 4 0 |
| T. Tilling | 10 | 10 | 58/– | +2/– | 3 9 0 |
| West Riding | 10 | 10 | 44/6 | .. | 4 10 0 |

(*Continued on next page*)

* Dividends are paid free of Income Tax.

| Company | Dividend Previous | Dividend Last | Middle Price Feb. 15 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|
| **Equipment and Manufacturing** | | | | | |
| Aron.Elec.Ord. .. | 10 | 15 | 55/– | .. | 5 9 1 |
| Assoc. Elec. : | | | | | |
| Ord. .. .. | 10 | 10 | 51/3 | .. | 3 18 0 |
| Pref. .. .. | 8 | 8 | 38/6 | .. | 4 3 1 |
| AutomaticTel.&Tel. | 12½ | 12½ | 59/3 | +6d. | 4 4 2 |
| Babcock & Wilcox | 11 | 11 | 50/– | .. | 4 8 0 |
| British Aluminium | 10 | 10 | 48/– | .. | 4 3 4 |
| British Insul. Ord. | 20 | 20 | 5½ | .. | 3 15 4 |
| British Thermostat (5/–) .. .. | 18½ | 18½ | 19/– | .. | 4 17 4 |
| BritishVac.Cleaner (5/–) .. .. | 15 | 30 | 27/6 | .. | 5 9 1 |
| Brush Ord.(5/–).. | 6 | 8 | 8/6 | .. | 4 14 2 |
| Burco (5/–) .. | 15 | 17½ | 15/6 | .. | 5 13 0 |
| Callender's .. | 15 | 20 | 101/3 | –9d. | 3 18 9 |
| ChlorideElec.Storage | 15 | 15 | 80/– | .. | 3 15 0 |
| Cole, E. K. (5/–) | 10 | 15 | 26/– | .. | 2 17 10 |
| Consolidated Signal | 24 | 27½ | 6 | .. | 4 12 0 |
| Cossor, A. C. (5/–) | 7½* | 10* | 23/– | +1/– | 2 3 6 |
| Crabtree (10/–) .. | 17½ | 17½ | 38/3 | .. | 4 11 5 |
| Crompton Parkinson Ord. (5/–) .. | 20 | 22½ | 28/– | +1/– | 4 0 4 |
| E.M.I. (10/–) .. | 6 | 8 | 27/6 | .. | 2 17 2 |
| Elec.Construction | 10 | 12½ | 50/6 | .. | 4 19 0 |
| EnfieldCableOrd. | 12½ | 12½ | 59/– | .. | 4 4 8 |
| Engish Electric . | 10 | 10 | 49/9 | .. | 4 0 6 |
| EnsignLamps(5/–) | 25 | 15 | 20/– | .. | 3 15 0 |
| Ericsson Tel. (5/–) | 22* | 20* | 51/3 | .. | 1 19 0 |
| Ever Ready (5/–) | 40 | 40 | 39/– | .. | 5 2 7 |
| Falk Stadelmann | 7½ | 7½ | 32/9 | .. | 4 11 7 |
| Ferranti Pref. .. | 7 | 7 | 29/6 | .. | 4 15 0 |
| G.E.C. : | | | | | |
| Pref. .. .. | 6½ | 6½ | 33/– | .. | 3 18 9 |
| Ord. .. .. | 17½ | 17½ | 91/3 | .. | 3 16 9 |
| Greenwood&Batley | 15 | 15 | 41/3 | .. | 7 5 9 |
| HallTelephone(10/–) | 12½ | 12½ | 25/6 | .. | 4 18 1 |
| Henley's (5/–) .. | 20 | 20 | 25/6 | .. | 3 18 8 |
| 4½% Pref. .. | 4½ | 4½ | 23/– | .. | 3 18 3 |
| Hopkinsons .. | 15 | 17½ | 61/3 | +½ | 5 14 2 |
| India Rubber Pref. | 5½ | 5½ | 21/6 | .. | 5 2 4 |
| Intl. Combustion | 30 | 30 | 6½ | .. | 4 18 0 |
| Johnson & Phillips | 15 | 15 | 70/– | +6d. | 4 5 9 |
| LancashireDynamo | 20 | 22½ | 92/6 | +6d. | 4 17 6 |
| Laurence,Scott(5/–) | 12½ | 12½ | 13/– | .. | 4 16 2 |
| London Elec. Wire | 7½ | 7½ | 34/6 | .. | 4 7 0 |
| Mather & Platt.. | 10 | 10 | 56/3 | +½ | 3 11 2 |
| Metal Industries(B) | 5 | 8 | 44/3 | .. | 3 12 2 |
| Met.Elec.CablePref. | 5½ | 5½ | 21/3 | .. | 5 3 6 |
| Murex .. .. | 20 | 20 | 101/3 | .. | 3 19 0 |
| Pye Deferred (5/–) | 25 | 25 | 26/3 | .. | 4 15 3 |
| Revo (10/–) .. | 17½ | 17½ | 38/6 | .. | 4 11 0 |
| Reyrolle .. | 12½ | 12½ | 68/9 | .. | 3 13 8 |
| Siemens Ord. .. | 7½ | 7½ | 33/6 | +6d. | 4 9 7 |
| Strand Elec. (5/–) | 7½ | 10 | 7/9 | .. | 6 9 0 |
| Switchgear& Cowans (5/–) .. | 10 | 20 | 18/– | .. | 5 11 1 |
| T.C.C. (10/–) .. | 5 | 5 | 18/9 | .. | 2 13 4 |
| T.C. & M. .. | 10 | 10 | 52/– | +1/– | 3 17 0 |
| TelephoneMfg.(5/–) | 9 | 9 | 11/– | .. | 4 1 10 |
| Thorn Elec. (5/–) | 20 | 20 | 22/6 | .. | 4 9 0 |
| Tube Investments | 20 | 20 | 96/– | .. | 4 3 4 |
| Vactric (5/–) .. | Nil | Nil | 12/9 | .. | — |
| Veritys (5/–) .. | 7½ | 7½ | 7/3 | .. | 5 3 5 |
| Vickers (10/–) .. | 10 | 10 | 18/9 | +3d. | 5 6 8 |
| WalsallConduits(4/–) | 55 | 55 | 44/6 | .. | 4 18 9 |
| Ward & Goldstone (5/–) .. .. | 20 | 20 | 27/– | .. | 3 14 5 |
| WestinghouseBrake | 12½ | 14 | 70/– | .. | 4 0 0 |
| West, Allen (5/–) | 7½ | 7½ | 6/9 | .. | 5 11 2 |

* Dividends are paid free of Income Tax.

## Stocks & Shares (*Continued from page* 245)

favourable turn, Anglo-Argentine Tramways stocks are better in consequence. The income debenture at 8 has put on three points in the last fortnight. It is expected that next month there will appear a report from a special committee appointed in Argentina to study the nationalisation of all privately-owned telephone companies. The principal telephone company is a subsidiary of the International Telephone & Telegraph Co. This may, some think, be the first step taken by the Argentine Government towards nationalising all public utilities in the Republic.

### Thomas Tilling

Thomas Tilling, registered 47 years ago, has a record of almost unbroken progress, and the latest report for the year ended December, 1943, shows that the company earned 16 per cent. on the ordinary stock on which it is paying 10 per cent. dividend. This rate has been distributed annually for the past seven years. There was a capital bonus in 1935 of 25 per cent. : the present capital is £4,120,000 in ordinary stock. According to the latest report, published the other day, the company has sold its £245,000 London Transport "A" and "B" stocks, making a profit on the deal, but has retained its £1,207,700 Transport "C" stock. The price of the shares has risen 2s. to 58s.

### Dominion Relief

With income tax standing at 10s. in the £, importance attaches to the Dominion relief which is permitted in certain cases of dividend payments by companies having head offices that are domiciled outside the United Kingdom. The concession varies in amount from half-year to half-year. The Cawnpore Electric Supply Co. is one of those whose dividend payments are subject to a reduced rate of tax. Last time, the tax was 5s. 9d. in the £. The Kalgoorlie Electric Power & Lighting Co. is another whose dividends "attract" a lower rate of tax, this at present being 5s. in the £. At 10s. 9d., at which 3,000 of the 10s. ordinary shares are on offer, the yield comes to £4 13s. per cent. The Nigerian Electric Co. pays its dividends subject to a reduced rate of tax; last year it was 6s. 2d. in the £. This Dominion tax relief makes a material difference to the net yield on the shares.

# NEW PATENTS

## *Electrical Specifications Recently Published*

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

J. C. ARNOLD (W. S. Tyler Co.).—" Means for producing low-frequency pulsating current from an alternating-current supply." 15180. October 29th, 1942. (558931.)

British Thomson-Houston Co., Ltd.—" Power factor adjustment in electric supply circuits, particularly in welding circuits using transformers." 8664/42. June 27th, 1941. (558952.) " X-ray generators." 12610/42. September 8th, 1941. (559004.)

British Thomson-Houston Co., Ltd., and H. C. Hastings.—" Electric motor control systems." 5409. April 22nd, 1942. (558886.)

Brunto Patents, Inc.—" Coupling means for electric cables." 7127/42. June 10th, 1941. (558951.)

E. K. Cole, Ltd., and A. W. Martin.—" Electric transformers." 18060. December 19th, 1942. (558943.)

J. Davis & Son (Derby), Ltd., and C. Dawson. —" Solenoid-operated electric bells." 15173. October 29th, 1942. (558930.)

F. B. Dehn (National Telephone Supply Co.). —" Wire-holding device." 8732. June 25th, 1942. (558856.)

L. Del Riccio.—" Devices for regulating the speed of electric motors and for photographing moving objects." 7011. May 22nd, 1942. (558890.)

Hazeltine Corporation. — " High - voltage direct-current supply system." 4684/42. April 4th, 1941. (558884.)

Heenan & Froude, Ltd. and C. T. Hayes.— " Electric eddy current brakes, dynamometers and clutches." 10061. July 20th, 1942. (558961.)

F. G. Horstmann.—" Inspection lamps." 12930. September 14th, 1942. (Addition to 537151.) (559006.)

Igranic Electric Co., Ltd. (Cutler Hammer, Inc.).—" Electro-magnetically operated step-by-step mechanism." 10385. July 24th, 1942. (558969.)

A. Katz.—" Wind turbine." 15066. October 27th, 1942. (558929.)

H. G. Lubszynski and Electric & Musical Industries, Ltd.—" Electron-discharge devices." 10062. July 20th, 1942. (Addition to 542496.) (558962.)

Marconi's Wireless Telegraph Co., Ltd.— " Noise control circuit for angular velocity modulation receivers." 14793/42. October 22nd, 1941. (558877.) " Impulse phase-measuring systems." 15292/42. October 31st, 1941. (558933.) " High-frequency power valves." 10100/42. January 2nd, 1941. (558964.) " Television transmission." 12858/42. January 31st, 1941. (559005.)

Marconi's Wireless Telegraph Co., Ltd., and E. Green.—" Directional aerial systems." 6926. May 21st, 1942. (558852.)

E. M. Morris.—" Electric motors." 6886. May 20th, 1942. (558914.)

Messier Aircraft Equipment, Ltd., A. Arnot and H. G. Conway.—" Electrical remote control devices." Cognate applications 8750/42 and 17389/42. June 25th, 1942. (558953.)

S. J. Smith.—" Adjustable instruments having a rotor and a stator." 10150. July 21st, 1942. (558860.)

Soc. Anon, pour l'Industrie de l'Aluminium.— " Electric furnaces for the electro-thermal production of metallic magnesium." 10686/42. July 23rd, 1941. (558972.)

Soc. Genèvoise d'Instruments de Physique.— " Photo-electric apparatus for determining with precision the position of an object carrying a graduation." 15657/41. December 28th, 1940. (558848.)

E. S. Solomon.—" Dish washing and like machines." 8692. June 24th, 1942. (558915.)

Standard Telephones & Cables, Ltd.—" Cooling devices for electron-discharge devices." 11932/42. August 28th, 1941. (558975.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and D. M. Ambrose.—" Television." 10371. July 24th, 1942. (558927.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and L. W. Haughton.—" Generators of periodically varying electric currents." 10151. July 21st, 1942. (558861.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and C. T. Scully.—" Thermionic valve amplifiers." 10293. July 23rd, 1942. (558923.)

Standard Telephones & Cables, Ltd., B. B. Grace, J. Handley and G. Gilliver.—" Mounting jewels for instrument bearings," 10152. July 21st, 1942. (558862.)

J. Swinney and Metropolitan-Vickers Electrical Co., Ltd.—" Electric circuit-breakers having trip mechanism." 14998. October 26th, 1942. (558878.)

Telephone Manufacturing Co., Ltd. and T. H. Whale.—" Electric switches operated by tension members." 15877. November 10th, 1942. (558936.)

---

# TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be made within one month from February 9th :—

BRYANISED (design). Class 9. No. 625,934. Electric conductor wire.—British Ropes, Ltd., Carr Hill, Doncaster. (To be associated with No. 623,729 (3425) (vi).)

SIMLON. Class 9. No. 626,040. Electric wire, electric cables, electric conduits and flexible electric conductors.—F. D. Sims, Ltd., Hazelhurst Works, Regent Street, Ramsbottom, Lancs.

SABAEBAR. Class 17. No. 625,800. Synthetic resin varnish for electrical insulation purposes; and SABALIN. Class 17. No. 625,801. Electrical insulating material made of fireclay, starch and synthetic resin.—Joseph Sankey & Sons, Ltd., Albert Street Works, Bilston, Staffs.

BICORT. Class 17. No. 626,625. Electrical insulating material.—British Insulated Cables, Ltd., Prescot, Lancs.

# CONTRACT INFORMATION

## *Accepted Tenders and Prospective Electrical Work*

## Contracts Open

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.*

**Belfast.**—March 7th. Electricity Department. —Stores. (February 11th.)

**Birkenhead.**—February 19th. Town Council. Air-conditioning plant at the New Ferry depot. Details from the general manager, Transport Department, Laird Street.

**Darlington.**—Town Council. Wiring of transport workshops, Haughton Road, for lighting and power. Plans by the transport manager, Haughton Road.

**Manchester.**—March 3rd. Electricity Department. 33- and 6·6-kV switchgear at generating stations and substations. (February 11th.)

**Wilton.**—March 1st. Town Council. Electric motor and close-coupled centrifugal pump (9,000 gal. per hr. against a maximum head of 196 ft.). Specifications from the town clerk.

## Contracts in Prospect

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Bakewell.**—Houses, Ivy Lane and Back Lane, Elton, for R.D.C.; H. Haywood, builder, 354, Loxley Road, Owlerton, Sheffield.

**Bath.**—Wartime nursery, Beaufort East; J. Owens, city engineer, Guildhall.

**Birmingham.**—Nurseries (£2,150); city engineer.

**Bootle.**—Additions, Maghull Sanatorium; borough engineer.

**Burnage.**—Isolation ward, Duchess of York Hospital for Babies; Bradshaw, Gass & Hope, architects, 19, Silverwell Street, Bolton.

**Cheltenham.**—Houses (4), Kipling Road; borough engineer.

**Coventry.**—Kitchen block, Southbank School; D. E. E. Gibson, city architect, 1a, Warwick Row.

**Dorset.**—Classrooms, Parkstone Grammar School (£1,000); county architect, Shire Hall, Dorchester.

**Gateshead.**—Factory additions, Park Road; Scottish Motor Traction Co., Ltd.

Dairy for Gateshead Co-operative Society; Architect's Department, C.W.S., Westmoreland Road, Newcastle-on-Tyne.

Sculleries at seven schools; J. Sutton & Son, builders, Gateshead.

**Hampshire.**—Additions at Purbrook High School; county architect, The Castle, Winchester.

**Hebden Royd.**—School canteen and kitchen, Burnley Road Council School; H. L. Bottomley, surveyor, Council Offices, Hebden Bridge.

**Hereford.**—Dining hall, Hampton Dene Road; W. M. Shimmin, city surveyor, Town Hall.

**Hornsey.**—Wartime day nursery, Priory Road; J. H. Melville Richards, borough engineer, Town Hall, Crouch End, Broadway, N.8.

**Lancashire.**—Central kitchen, Penwortham (£4,306); P. A. Baines & Son (Preston), Ltd., building contractors, Ribble Saw Mills, Payley Road, Preston.

**Liverpool.**—Thoracic unit (£1,725), Broadgreen Hospital, and maternity accommodation (£2,000), Walton Hospital; L. H. Keay, city architect, Blackburn Chambers, Dale Street.

**Lytham St. Annes.**—School kitchen and dining hall, Lansdowne Road, Ansdell; G. W. Lawson, borough surveyor, Town Hall.

**Macclesfield.**—Two wards (£10,000); secretary, Macclesfield Infirmary.

**Manchester.**—Dairy and pasteurisation plant, Langho Mental Colony (£3,371); G. N. Hill, city architect, Town Hall, Albert Square,

Kitchen and boiler house; R. Buck, Ltd., haulage contractors, 11, Ladybarn Road, Manchester 14.

**Merioneth.**—Extension of County Offices, Dolgelley; Hugh J. Owen, County Offices, Dolgelley.

**Newcastle-on-Tyne.**—Works extensions for G. Angus & Co., Ltd., Walker Road; Stanley Miller, 17, North Street.

**Newport (I.O.W.).**—Restaurant, South Street (£1,502); A. E. Jukes & Son, Ltd., Southampton.

**Northamptonshire.**—R.C. senior school, Corby and school kitchen, Hardingstone; J. Perkins, county architect, County Hall, Northampton.

**North Riding.**—Adaptation of Danby C.E., Danby Castleton, Glaisdale, Glaisdale Lealholm and Moorsholm Schools and Goathland Parish Hall, for provision of meals; county architect, County Hall, Northallerton.

**Plymouth.**—Nurses' home, Didworthy Sanatorium, South Brent; city architect, Compton Park House, Tavistock Road.

**Reading.**—Joint food office, site fronting Rose Street; borough surveyor, Town Hall.

**Rochester.**—Canteen kitchen, Balfour Road; city surveyor, King Edward Road.

**Rowley Regis.**—School canteen, Blackheath; Pritchard, Godwin & Clist, architects, Bank Buildings, Kidderminster.

**Salford.**—Reinstatement of upper floor of Tootal Road Council School; W. A. Walker, borough engineer, Town Hall, Bexley Square, Salford 3.

**Scarborough.**—British Restaurant in St. Thomas Street (£3,500); borough engineer.

**Sheffield.**—Nursery (£1,999), Beck Road School; M. J. Gleeson, Ltd., building contractors, 822, Chesterfield Road.

**Stockport.**—School canteen kitchen, Great Egerton Street; L. Yates, education architect, Education Offices, Town Hall.

**Sunderland.**—Bakery, Cleveland Road; G. T. Brown & Son, architects, Fawcett Street.

**Surrey.**—Hutments for patients, Warren Road Hospital, Guildford; county architect, County Hall, Kingston-on-Thames.

**Swindon.**—Repairs and electrical installation at convalescent home (£1,665); borough engineer.

**Warrington.**—Conversion of "Hill Crest," Balmoral Road, Grappenhall, into nurses' home; H. L. Boot, superintendent and secretary, Infirmary, Warrington.

**York.**—Experimental houses; C. J. Minter, city engineer, Guildhall.

## Forthcoming Events

**Institution of Electrical Engineers.**—Monday, February 21st, 5.30 p.m. Informal discussion on "Use of Electricity in the Equipment and Testing of Aircraft," to be opened by Mr. C. G. A. Woodford (Ministry of Aircraft Production).

*Wireless Section.*—Wednesday, February 23rd, 5.30 p.m. "Survey of Problems of Post-War Television," by Mr. B. J. Edwards.

*North-Western Centre.*—Saturday, February 19th, 2.30 p.m. Engineers' Club, Manchester. Informal discussion on "Post-War Planning for Improvement in Electricity Supply," to be introduced by Mr. W. Fennell.

*Mersey and North Wales (Liverpool) Centre.*—Monday, February 21st, 5.30 p.m. Liverpool Royal Institution, Colquitt Street. "Wave Guides in Electrical Communication," by Mr. J. Kemp.

*North-Eastern Centre.*—Monday, February 28th, 6.15 p.m. Neville Hall, Newcastle-on-Tyne. "Effect of the National Grid on the Operation and Maintenance of Secondary Power Stations," by Mr. R. A. W. Connor.

*North Midland Centre.*—Tuesday, February 22nd, 6 p.m. Great Northern Hotel, Wellington Street, Leeds. "Maintenance of Distribution Plant and Mains on AC Networks," by Messrs. F. N. Beaumont, B.Sc.(Eng.) and F. A. Geary.

*West Wales (Swansea) Sub-Centre.*—Saturday, February 19th. "Bonded Deposits on Economiser Heating Surfaces," by Messrs. J. R. Rylands and J. R. Jenkinson.

*East Midland Sub-Centre.*—Wednesday, February 23rd, 2.30 p.m. Demonstration Theatre, Corporation Gas Department, Nottingham. "Ventilation of Substations," by Messrs. F. Favell and E. W. Connor, B.Sc. (Joint meeting with Institution of Heating and Ventilating Engineers.)

*Devon and Cornwall Sub-Centre.*—Thursday, February 24th, 3.30 p.m. Globe Hotel, Courtenay Street, Newton Abbot. "Protective Systems for Rural Distribution up to 33 kV," by Messrs. R. W. Steel and A. W. Allwood, B.Sc.

*North-Eastern Students' Section.* — Friday, February 25th, 6.30 p.m. Neville Hall, Newcastle-on-Tyne. "Reflectors and their Application to Different Types of Illumination," by Mr. F. Treliving.

*London Students' Section.*—Monday, February 28th, 7 p.m. "Power Station Auxiliaries," by Mr. G. T. Shears.

*South Midland Students' Section.*—Tuesday, February 29th, 6.30 p.m. James Watt Institute, Birmingham. "Mercury Arc Rectifiers," by Mr. H. B. Calverley, B.Sc.

*North-Western Wireless Group.*—Friday, February 25th, 6 p.m. Engineers' Club, Manchester. "Enemy Airborne Radio Equipment," by Mr. C. P. Edwards.

*South Midland Wireless Group.*—Monday, February 28th, 6 p.m. James Watt Institute, Birmingham. "Wave Guides in Electrical Communications," by Mr. J. Kemp.

**Association of Mining Electrical and Mechanical Engineers.** — *Yorkshire North-West and South-East Branches.*—Wednesday, February 23rd. Technical College, Barnsley. Annual Report of H.M. Electrical Inspector of Mines.

*South Wales Branch.*—Saturday, February 19th, 5 p.m. Monmouth Mining and Technical College, Crumlin. "Brains Trust."

**Institution of Civil Engineers.**—Tuesday, February 22nd, 5.30 p.m. "Engineering Evolution of London Transport," by Mr. V. A. M. Robertson, C.B.E., M.C.

**Institute of Fuel.**—*Manchester.*—Wednesday, February 23rd, 2.30 p.m. Engineers' Club. Conference on "Industrial Furnaces."

**Commercial Electric Refrigeration Association.**—Wednesday, February 23rd, 1.15 p.m. Connaught Rooms, W.C.2. Annual luncheon.

**Institution of Mechanical Engineers.**—Friday, February 25th, 5.30 p.m. Informal open discussion on "Troubles, Breakdowns and their Cures."

**Illuminating Engineering Society.**—*Birmingham Centre.*—Friday, February 25th, 6 p.m. Imperial Hotel. Symposium on Lighting.

**Electrodepositors' Technical Society.**—*London.*—Monday, February 28th. Northampton Polytechnic, E.C.1. "Electrodeposition of Brass," by Dr. J. Kronsbein.

## Cardiff I.E.E. Students

A SUGGESTION has been made for the formation of a Students' Section of the Institution of Electrical Engineers for the Cardiff district. The proposed area to be served would be Cardiff, Newport, Bridgend and the valleys immediately behind these towns, so that Bridgend would be the western limit and the Eastern Valley the eastern limit. Those interested should communicate with Mr. T. B. Rolls, "Berwyn," Fairwater Road, Llandaff, Cardiff.

## Overseas Standards

OVERSEAS specifications recently received by the British Standards Institution, 28, Victoria Street, London, S.W.1, where they may be inspected or obtained on loan, include the following :—

*American Standards Association:* C39·3-1943 shock-testing mechanism for panel type instruments of small diameter, C76·1-1943 apparatus bushings and test code for same, C77·1-1943 wet tests, C39·4-1943 dimensions for external radio-frequency thermo-couple (120 mA to 10 A) convertors, C75·2-1943 steatite radio insulators, C75·8-1943 glass radio insulators.

*U.S. Federal Specification:* CC-M-641 integral horse power AC motors.

*Standards Association of Australia:* (E) C503-1943 ceramic radio insulating materials (American WS/C75·1 endorsed without amendment), (E) D·1504-1943 wooden separators for lead-acid accumulators.

*Canadian Engineering Standards Association:* war emergency revision to C22·2 No. 38 rubber covered wires and cables.